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Historical Account of the Los Angeles Mackerel Fishery

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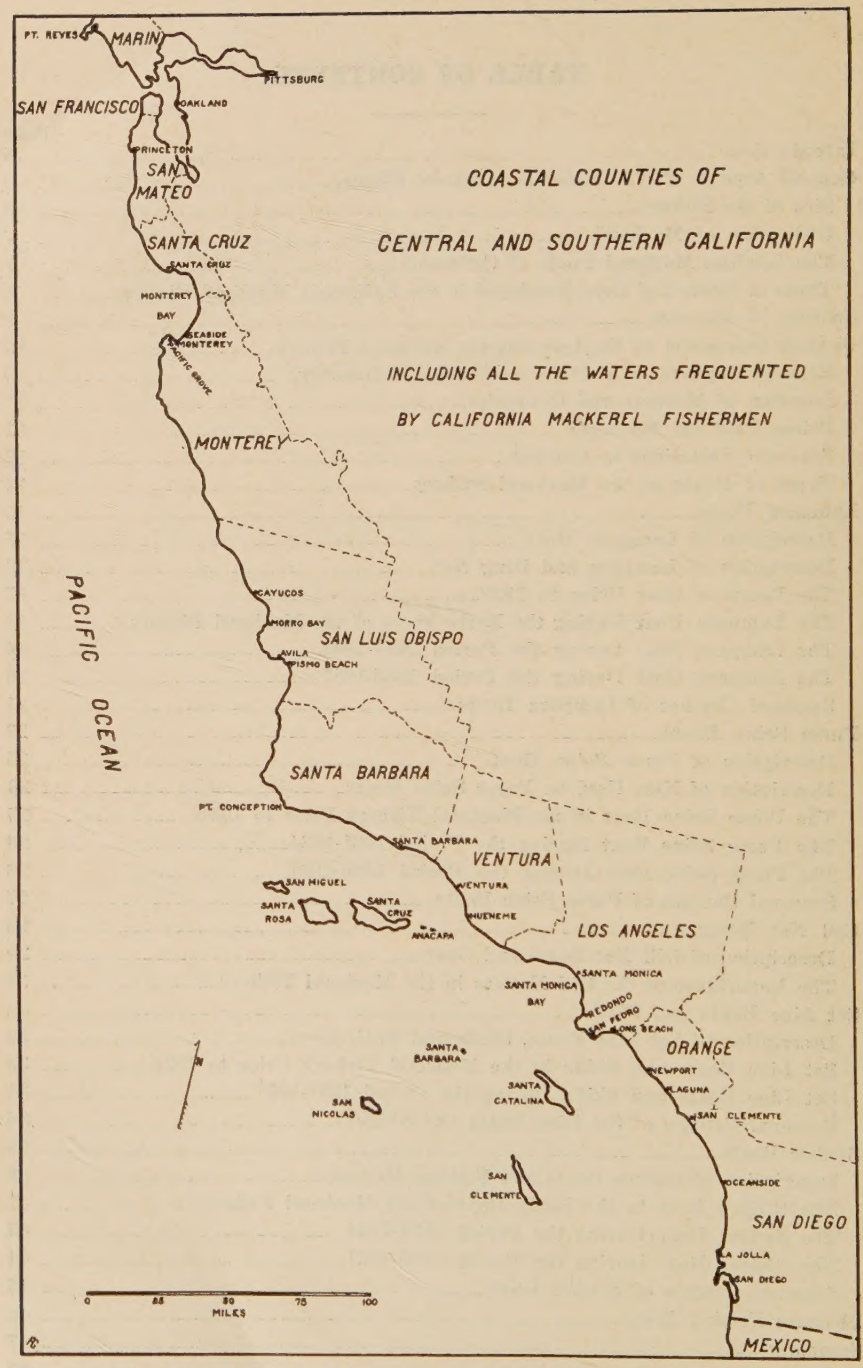

FIG. 1. Map of coastal central and southern California, showing the towns where the mackerel fishery is centered. Fishing grounds for San Pedro boats extend from Pt. Conception to Oceanside and include all the islands (1937).

HISTORICAL ACCOUNT OF THE LOS ANGELES MACKEREL FISHERY [1]

By RICHARD S. CROKER, California State Fisheries Laboratory

INTRODUCTION

The mackerel is one of the leading commercial fishes of California; its catch is exceeded only by that of the sardine. However, for many years prior to 1928, the fishery based on the Pacific mackerel, *Pneumatophorus diego,* was relatively unimportant. Since the turn of the century the mackerel had supplied a steady but limited demand for fresh fish, but at no time was any appreciable part of the great number of mackerel in the ocean utilized. In 1928 the first large scale canning of mackerel took place. The subsequent development of the mackerel canning industry provides one of the most spectacular pages in the history of the world's fisheries. Almost overnight the mackerel catch rose from tenth to second place among the fisheries of California.

Today ever-expanding fishing operations are endangering the supply of mackerel. In the not too distant future it will be necessary to impose restrictions on the industry so that it can continue to exist. At present there is no legislation in California pertaining to the mackerel specifically. Such legal protection as it receives consists of general gear restrictions, the establishment of areas closed to all commercial fishing, and the application of general laws prohibiting the waste of fish or the manufacture of fish into meal and oil.

The mackerel fishery, being new and still growing, is changing rapidly. Differences in gear and in boats are to be noted during the first few years of its development. It is the purpose of this paper to present a study of the fishery during its formative period, with particular emphasis on the boats comprising the mackerel fleet, in order to facilitate direct comparisons in future years. In this connection it can be said that the present account is a sequel to the general report issued as Fish Bulletin 40 (Croker, 1933). In the brief interval since the publication of that paper, a number of developments have taken place in the industry, illustrating the changing character of this fishery.

[1] Submitted for publication October, 1937.

GENERAL ASPECTS OF THE CALIFORNIA MACKEREL FISHERY

Size of the Fishery

The mackerel fishery is the third largest in California.[2] For the years 1933 to 1936, inclusive, landings averaged 107,600,000 pounds. Prior to 1928, however, mackerel was not an important fish. In that year the mackerel canning industry commenced, and as markets expanded, the catch increased enormously. The 1928 catch was about 35,200,000 pounds, of which 30,000,000 pounds was delivered to canneries. In 1929 the catch was considerably greater as canners increased their capacity. The economic depression commenced in 1930 in so far as the mackerel industry was concerned and it slowed production for three years, during which time landings averaged 14,400,000 pounds. Favorable marketing conditions in 1933 enabled the canners to pack on a large scale again. As a consequence landings increased suddenly to record-breaking figures. (See Fig. 2.)

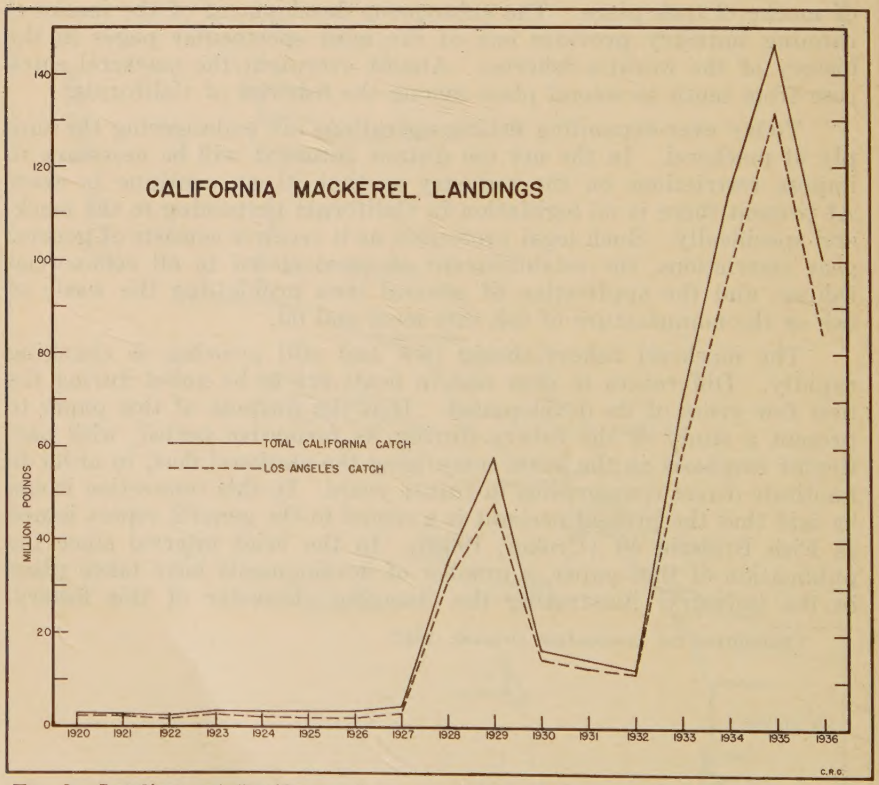

FIG. 2. Landings of Pacific mackerel in California for the years 1920 to 1936, inclusive. Prior to 1926, horse mackerel was not separated from Pacific mackerel in catch reports, so the early years include landings of both species. Note how Los Angeles dominates the mackerel fishery.

[2] The sardine fishery is the leading fisheries industry from the standpoint of tonnage. The tuna fishery, based on five species of tuna, is first in value and second in pounds landed. Until 1936 the mackerel was second in tonnage, but in that year the rapidly growing tuna fishery passed it. The mackerel fishery is now third, both in value and in tonnage.

Utilization of Mackerel

Until 1928, mackerel was essentially a fresh market fish, although small amounts were canned and salted from time to time. Deliveries to the wholesale markets showed a gradual increase during the first quarter of the twentieth century and reached their peak in 1928, during which year nearly 6,000,000 pounds was delivered to the markets. Since that time the fresh fish catch has dropped approximately two million pounds and has steadied at a level slightly above the average for the years 1920 to 1927. Fresh mackerel is sold throughout California and other western states.

While the catch of mackerel destined for fresh consumption has remained rather constant, cannery landings have showed great fluctuations. As mentioned above, the canneries took very little fish prior to 1928. Since then cannery deliveries have been large, but not constant, ranging from about 11,000,000 pounds a year in 1930, 1931 and 1932 to 143,000,000 pounds in 1935. (See Figs. 2 and 4.) The rise in 1928 and 1929 was due to expanding cannery operations, the slump in 1930 was caused by a contraction of markets brought about by the depression, and the subsequent rise from 1933 to 1935 was due to improved marketing conditions. In spite of intensive fishing, landings in 1936 and 1937 were progressively poorer because of a scarcity of fish (Fry, 1937).

During 1928 and 1929 most of the canned mackerel was exported, principally to the Philippine Islands and the East Indies. Since 1929, foreign markets have contracted and domestic sales have increased, so that now the bulk of the production is consumed in the United States. Canned mackerel is sold in all parts of the country, but principally in the southern states.

Relatively small amounts of mackerel are utilized by the fish salting and smoking trades and even smaller amounts are used as bait by anglers and commercial fishermen. However, at present the canning industry overshadows all other combined phases of the mackerel fishery.

The Leading Mackerel Ports of California

Los Angeles Harbor is far and away the leading mackerel port of California. This port, together with Newport Beach, which is in the same region, accounts for the bulk of the state catch. (See Fig. 3.)

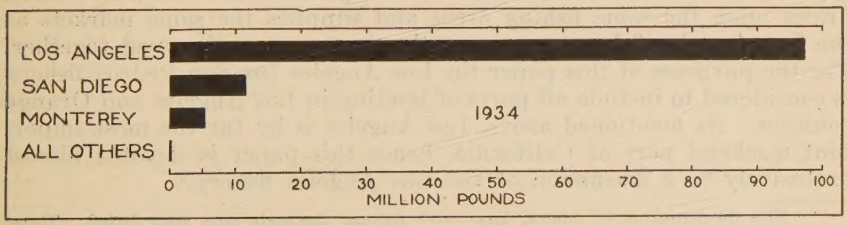

Fig. 3. California mackerel landings by regions, 1934.

About 85 per cent of all California cannery landings are made in the Los Angeles region. (See Fig. 2.) The remainder is landed at San Diego and Monterey. During the past five years the canners of those three ports have made every effort to obtain all the mackerel

possible. The Los Angeles canners have been more successful than the others for two reasons: mackerel are more abundant in southern California than farther north, so San Pedro fishermen are able to catch more than Monterey fishermen; there are more boats at San Pedro than at San Diego and the larger fleet is able to bring in more fish, hence the leadership of San Pedro over San Diego.

The major ports of landing for fresh mackerel are, in order of importance: Los Angeles, Monterey, San Diego and Newport Beach.

Types of Boats and Gear Employed in the California Mackerel Fishery

A great variety of fishing gear is used in the capture of mackerel. This fish is taken in commercial quantities by hook and line, by impounding nets and by entangling nets.

The mackerel fishery formerly depended almost entirely upon line-caught fish. Hook and line boats, however, are not capable of catching mackerel in large quantities, so when canning started on a large scale it was necessary to call into use the more efficient net boats. At present, it can be said that in general, hook and line boats provide most of the mackerel for the fresh fish markets and the net boats furnish the canneries with their supply.

Three types of lines are employed: set lines, hand lines and pole lines. Impounding nets are of four varieties: lampara, ring net, purse seine and dip net. The two types of entangling nets in use are gill nets and trammel nets.

Almost every type of boat engaged in California's marine fisheries participates to some extent in the mackerel industry. Skiffs, dories and the smallest power boats employ set lines and hand lines almost exclusively. Boats of 30 to 50 feet in length use any and all of the kinds of gear mentioned above, with the exception of purse seines. Many of these medium sized craft change from one type of gear to another at different seasons. The largest boats, 50 to 85 feet long, use ring nets or purse seines.

The following pages describe the various fishing methods and types of boats and discuss the importance of each in the Los Angeles mackerel fishery. The same kinds of lines, nets and boats are used at San Diego and Monterey, although the relative importance of the several types of boats is not quite the same at all points. The Newport fishery draws upon the same fishing areas and supplies the same markets as the Los Angeles fishery, consequently the two are discussed together. For the purposes of this paper the Los Angeles (or San Pedro) fishery is considered to include all ports of landing in Los Angeles and Orange counties. As mentioned above, Los Angeles is by far the most important mackerel port of California, hence this paper is devoted almost exclusively to a discussion of the Los Angeles fishery.[3]

[3] The descriptions of boats, gear and fishing methods are very brief. Those who wish more detailed discussions of these subjects should refer to Fish Bulletin 40 (Croker, 1933). Further descriptions of various types of fishing gear can be found in the following publications:

Gill net—Whitehead (1930)
Lampara—Scofield (1929)
Purse seine—Whitehead (1931)
Ring net—Fry (1930.2)
Trammel net—Clark (1931)

SOURCES OF MATERIAL

The material for this paper has been obtained from field observations of California State Fisheries Laboratory staff members and from the statistical files of the California Division of Fish and Game.

The notes on fishing gear were obtained from actual observation, supplemented in some cases by the registration files of the Division. All commercial fishermen are required to register their boats annually, giving details on size, gear and kinds of fishing engaged in. The registration files were the source of the information on lengths and tonnages of boats presented in the following pages.

All sales of fish are required by law to be reported to the Division of Fish and Game. These reports are tabulated at the State Fisheries Laboratory and are made available to the public as summaries or combinations. In addition, they form the basis for special studies on fish catches and abundance carried on by Laboratory staff members.[4]

In making this study, each daily catch of mackerel for every boat operating in the San Pedro region during the period 1931-1934 was handled separately and treated as a unit. These individual catches were then combined in various ways: by boats, by type of boat, by months and by years. Tables 6 to 9, at the end of the text, give the monthly catches of each type of boat for the four-year period.

No detailed study was made of the entire mackerel fishery for the years 1935, 1936 and 1937, as it was considered most important to concentrate this survey on the early days of the fishery. A general discussion of these years is presented, however. The greatest value of this paper will be in making possible a comparison of conditions in the early days with conditions in the future.

[4] For a description of the California system of collecting and tabulating commercial fisheries records, see Conner (1935).

GENERAL DISCUSSION OF THE LOS ANGELES MACKEREL FISHERY

Relative Importance of Different Phases of Industry

Most of the mackerel caught in the Los Angeles region is canned (see Fig. 4); the remainder goes to fresh fish markets or is smoked or salted. During the years prior to 1928, the bulk of the catch was consumed fresh, but in that year canning methods were perfected and a market for canned mackerel was developed so that the canning industry soon outstripped the fresh fish trade. The market catch has not declined a great deal but the enormous increase in the cannery catch has made it look small by comparison.

The value, to the fishermen, of the 1934 cannery catch was about $580,000, and for the market catch it was approximately $36,000.

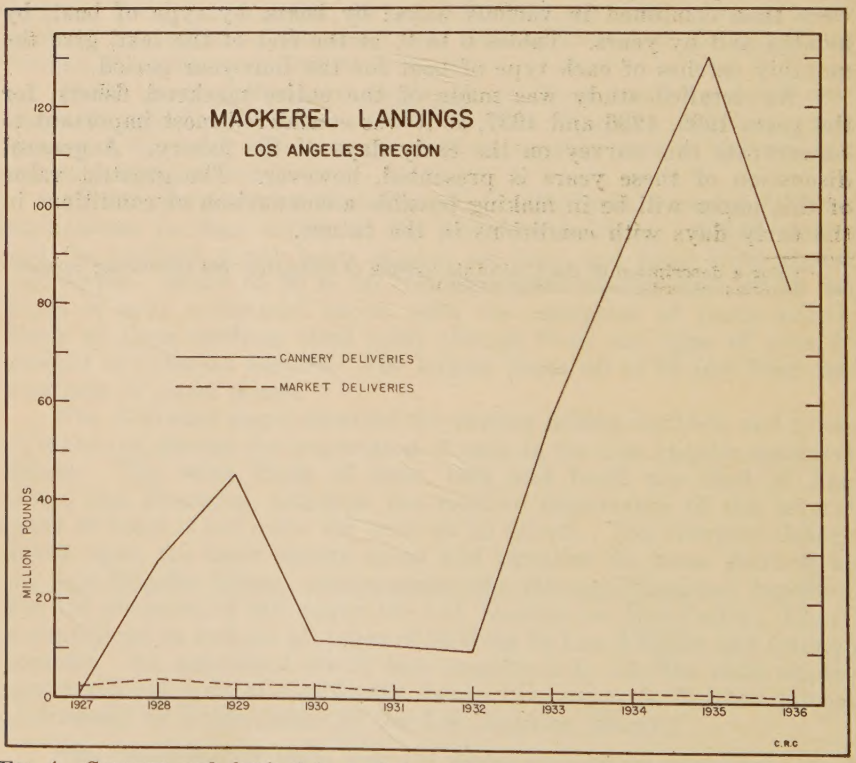

FIG. 4. Cannery and fresh fish market catches of mackerel in the Los Angeles region, 1927 to 1936, inclusive. The last year that market landings exceeded cannery deliveries was 1927; since then the canneries have dominated the industry.

Location of Markets and Canneries

The Los Angeles mackerel fishery centers at Los Angeles-Long Beach Harbor, which is known to the fishing industry as "San Pedro," although in reality it is composed of four towns: San Pedro, Wilmington, Long Beach and Terminal Island (East San Pedro). The largest wholesale fish markets are located in the town of San Pedro. Second in importance are the markets at Newport Beach, 25 miles down the coast. Other markets are to be found at practically all of the seashore towns in Los Angeles and Orange counties, for example: Santa Monica, Ocean Park, Venice, Redondo Beach, Long Beach and Laguna Beach. Most of the canneries are located in the San Pedro area, as shown in the following table:

LOCATION OF ACTIVE MACKEREL CANNERIES

	1932	1933	1934	1935	1936	1937
Terminal Island	3	4	4	6	7	8
Long Beach		1	2	2	3	3
Wilmington	1	1	1	2	2	2
Newport Beach				3	3	3
Totals	4	6	7	13	15	16

Prices Paid for Mackerel

The prices paid to the fishermen for their mackerel have varied considerably during the past few years. In general, the wholesale dealers pay more for their fish, as they are buying in smaller quantities and can afford to pay a premium for high quality. Their prices average about two cents per pound ($40 per ton), varying from one cent to three cents, depending upon market conditions. When the markets are flooded, the fishermen are unable to sell mackerel at any price.

Cannery prices are on a contract basis; that is, they are decided for a long time period by agreement between packers and fishermen. They have varied directly with economic conditions. The following table shows cannery prices (per ton) by years:

1928	$15.00 to $40 per ton until stabilization at $30.
1929	30.00
1930	30.00, dropped to $15 and then $10 in September.
1931	10.00, some canneries paid $8 toward end of year.
1932	8.00
1933	10.00, raised to $12.50 in September.
1934	12.50
1935	15.00, as of May 1.
1936	18.00, as of May 1.
1937	21.00, as of May 1.

As the prices paid by the canneries are lower, only boats capable of catching large quantities can afford to fish for them. On the other hand, because the wholesale markets will buy only small loads, it is only the small boats that can afford to fish for them. Hence, as a general rule, large boats deliver to the canneries and small boats land their fares at the markets.

Seasonal Variations in Catches

Mackerel catches fluctuate violently from month to month. The fluctuations are due to two causes—changing availability of the fish themselves, and variable economic demands for the fish.

The season of greatest landings is not the same at canneries and wholesalers. The canners, if they want mackerel at all, desire fish in large quantities, so that the canning seasons depend to a certain extent upon the whims of the packers. However, during 1933 and 1934 there was a constant demand for as many mackerel as possible so the canning seasons for those two years really reflected the actual availability of mackerel. In general it can be said that the packing season extends from May to December, inclusive, with the peak during the late summer

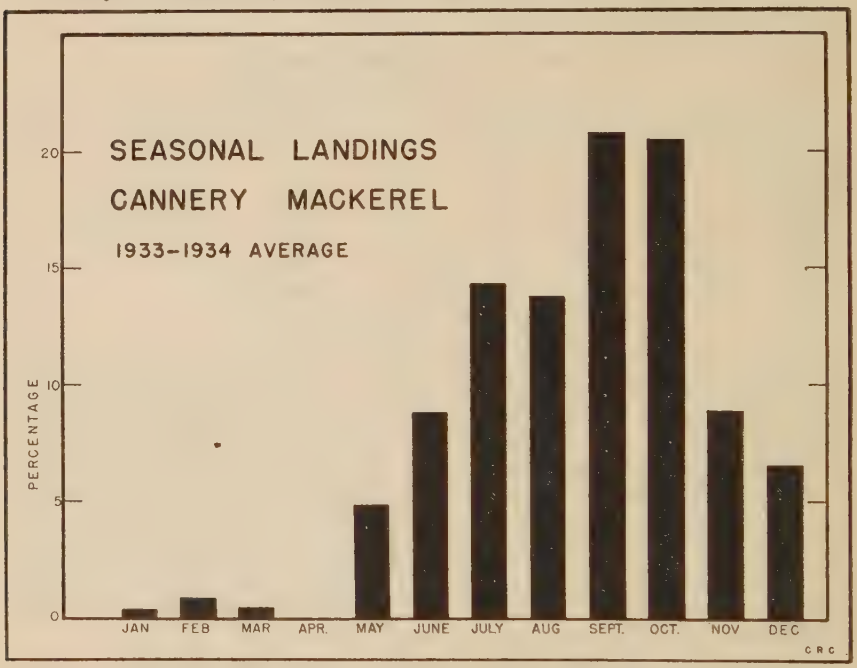

FIG. 5. Seasonal deliveries of mackerel to canneries in the Los Angeles region, 1933-1934. The peak of the cannery season is in the summer and fall when mackerel are available in the greatest numbers.

and early fall. (See Fig. 5.) A few mackerel are landed during January, February and March but practically none are obtainable in April. Because the sardine canning season commences in November, the packers sometimes limit their mackerel landings during November and December; otherwise the catches for those two months might be nearly as great as in October. However, the mackerel appear to become scarcer during December, and from the beginning of the year until mid-May are seldom available in quantities great enough for large-scale canning.

There seem to be sufficient mackerel present in local waters at all times to supply the rather limited market demand. Thus, seasonal fluctuations in the fresh fish catch are due to factors other than availability. Among market fish the mackerel is considered as a cheap, "fill-

in'' variety. When the higher-priced (*i.e.*, more desirable) species are scarce, mackerel are in demand, but when the more expensive fish are abundant the price of mackerel drops and the fishermen turn to fishing for the more lucrative kinds. Consequently, the peak of the fresh

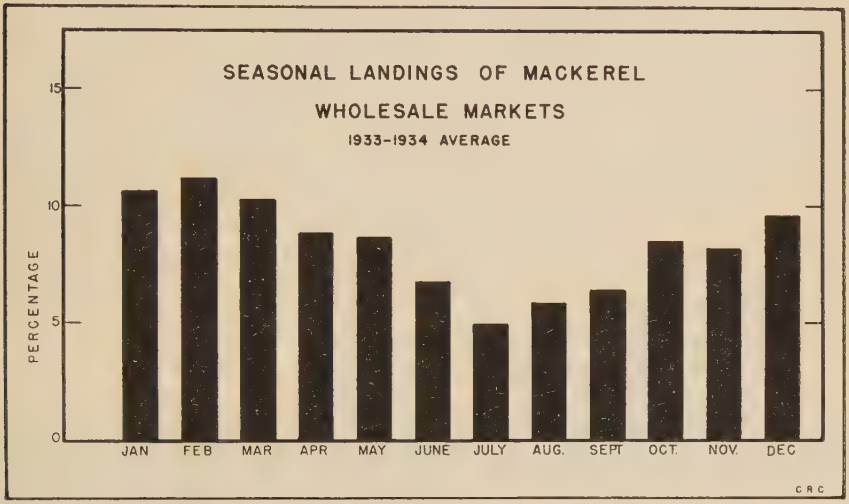

FIG. 6. Seasonal deliveries of mackerel to fresh fish markets in the Los Angeles region, 1933-1934. The peak of the market season is in the winter and spring when mackerel are in greatest demand for the fresh fish trade due to the seasonal scarcity of higher priced fish.

mackerel season is in the winter when most of the higher priced species are absent from local waters. Summer landings are slack because such fish as barracuda, sea-bass and yellowtail are plentiful at that time and mackerel are not in demand. (See Fig. 6.)

Types of Boats in the Mackerel Fishery

As mentioned previously, all kinds of boats and fishing implements are employed in the mackerel fishery. For the purposes of this discussion, seven different types of boats are considered—purse seine boats, lampara boats, gill net boats, set line boats, striker boats, skiffs, and pleasure boats. All are distinct, although the difference may be in the size and construction of the boat or in the gear used or both. A very few boats in the fleet do not fit any one category exactly; these have been assigned to the most satisfactory heading so that the complete catch is covered by a summation of the seven units.

Boats fishing with nets have been divided into three groups. Boats using gill nets and trammel nets fish in a different manner from those using encircling nets and are consequently grouped under a distinct heading, ''gill net boats.'' The various kinds of encircling nets (ring nets, purse seines and lamparas) are used on two general types of boats. The larger boats, which employ either ring nets or purse seines, are of a distinctive type of construction. They are called ''purse seine boats.'' The smaller boats use either lamparas or ring nets, sometimes changing from one to the other during the year. Although the ring net is now in much more general use for mackerel fishing than the lampara, the boats were built originally to use lamparas and are still called lampara

boats by the fishermen. Consequently, all circle net boats other than purse seiners are designated "lampara boats" in this paper.

The hook and line craft have been divided into four classifications. The group herein called "skiffs" includes skiffs and dories and all power boats under 20 feet in length, all using hand lines and set lines exclusively. All larger boats employing set or drift lines, hand lines and trolling lines are grouped together as "set line boats." For certain summaries skiffs and set line boats are combined. Boats which fish in the manner known as live bait or striker fishing, in which pole lines are used, have been termed "striker boats." This classification also includes boats that catch mackerel in dip nets, as such implements are used in connection with the lines to augment the catch, and can not be separated in the landings. The final classification is the "pleasure boat." Dozens of boats in southern California take paying passengers on fishing trips. These party boats and barges account for many tons of mackerel annually. Some of the pleasure fishermen sell their catches to the regular wholesale markets. Only those occasions when mackerel are sold (not merely caught) enter into the present study.

FIG. 7. San Pedro lampara type mackerel boat with ring net. This boat is 45 feet in length. Photograph by D. H. Fry, Jr., 1930.

A number of boats change from one type of gear to a totally different kind during the year. An example would be a boat that uses gill nets in the spring, takes out pleasure fishermen during the summer and fishes with a ring net in the fall. This boat would appear under three classifications in the following discussion, but would be counted only once in the annual total of all boats.[5]

[5] Such occurrences are noted in each annual table.

LAMPARA BOATS

Description of Lampara Boat

The type of net boat known as the lampara boat was a dominant factor in the mackerel fishery from the inception of the mackerel canning industry in 1928 until 1935.

The lampara boats used at San Pedro range from 30 to 60 feet in length. (See Fig. 8.) Net tonnages for all the lampara boats are below 15 tons and about a third are below 5 tons. All of them are at least 15 years old. Two general types are in use, the "Italian boats"

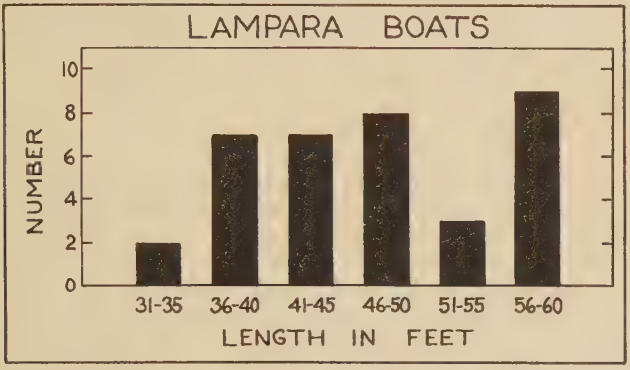

FIG. 8. Lengths of the 36 lampara type boats that fished regularly for mackerel at San Pedro in 1934. All these boats used ring nets.

and "Japanese boats." The former were built many years ago for Italian fishermen to fish with lamparas for sardines in the winter and for various market fish in the summer. Most of this group are still manned by Italians. The Japanese boats were originally built for hook and line albacore fishing in the summer and sardine netting during the winter. Most of them are operated now, as then, by Japanese. A newer type of circle net known as the ring net is used on nearly all of the lampara type boats at present.

The Italian boats are nearly all less than 45 feet long, with net tonnages of five or less, whereas most of the Japanese boats are longer than 45 feet. A few of the boats must carry their entire loads on deck although the majority have small fish holds. In all cases deckload capacities are greater than hold capacities. Most of the boats carry sideboards so that fish can be piled on deck to fantastic heights. A capacity load for the average Italian boat is about 20 tons. The larger Japanese boats can carry up to 40 or 50 tons of mackerel. When a lampara boat is fully loaded, the afterdeck and rail are under water and the net must be tied down so it will not wash away. The two types of boats are similar in appearance; figure 7 gives a better idea of what a lampara boat looks like than a detailed description could.

Besides the typical Italian and Japanese type boats there are a few nondescript boats of various kinds that can be classed as lampara boats. These are mostly converted pleasure craft and small boats built somewhat along purse seiner lines.

Description of Lampara and Ring Net

The lampara is a net designed to encircle and impound schools of fish in open water. It is made of tanned cotton webbing. The upper edge is held at the surface of the water by a light line strung with cork floats, and the lower edge is held down by a heavily weighted lead line. The net consists of three parts: two wings of coarse mesh and a central bag of fine mesh. The wings lengthen the net so that a large circle can be made. The lead line of the bag is much shorter than the cork line and the design of the bag is such that part of the webbing forms a "floor" under the fish when the net is circled. As the net is hauled toward the boat, the lead lines of the two wings come together under the fish and the space between the wings is greatly reduced. This closing-in tends to herd the fish into the bag, which by now can be likened to a huge scoop with its open end toward the boat. As soon as the wings are on board, the open end of the "scoop" is lifted out of the water by hauling the lead line aboard. The fish can not escape after that.

Lamparas used for mackerel fishing range from about 175 to 200 fathoms long and 20 to 45 fathoms deep in the bag. The mesh in the wings is 5 or 6 inches, stretched measure; in the throat it is 2 to 4 inches; and in the bag half to one inch. A lampara crew consists of 5 to 8 men. The so-called Japanese round haul net is similar to the lampara except that the bag is deeper and more simple in construction.

The lampara is carried in a pile on the afterdeck of the boat. The end of one wing is tied to the boat by a long rope; the other wing is tied directly to a skiff or buoy. When a school of mackerel has been located, the buoy is cast loose and the boat circles around the school while the crew pays out the net. When the float is picked up the boat comes to a stop and the crew divides, pulling in both wings simultaneously. This draws the boat and the scoop together. The use of scares, such as rocks, wooden paddles or poles, is resorted to so that the fish will be frightened back from going under the boat and escaping. When the wings are in, all the lead line is aboard, so the fish can escape only by jumping over the corks. The crew then hauls in all but the small part of the bag in which the fish are concentrated for scooping aboard.

The lampara is an effective net in fairly shallow water where the fish can not escape by sounding. It is particularly good for making fast hauls for small schools. Although the lampara fishes fairly deep, its effective depth is not great as the fish have a chance to escape under the net before the lead line is aboard.

In order to correct the shortcomings of the lampara, modifications were made and the ring net (also called purse lampara or half ring net) was developed. This net made its appearance at San Pedro in 1918 but was not generally used until 1926. It had become the universal small boat net for sardines and mackerel by 1929. It is, in effect, a lampara with a pursing arrangement whereby the lead line can be drawn together under the fish, effectively impounding them.

The ring net combines the light weight, negligible bulk, speed and low cost of the lampara with the positive action of the purse seine. Like the lampara it is made of tanned cotton webbing and has a cork line and lead line. The mesh in the central bag of a mackerel ring net is

2-inch, stretched measure. The webbing in the wings varies from 4-inch next to the bag to 8- or 10-inch at the ends. The wings are as deep as the bag where they join it but they taper a little toward the ends. There is a series of iron rings along the lead line; a purse rope is run through these rings to give the net its pursing action. The ring net is carried at the stern of the boat.

When a school of fish is sighted, one end of the net, tied to a buoy or skiff, is cast loose. The boat circles the school while the crew pays out the net. As soon as the circle is completed, the ends of the purse line are run through pulleys at the extreme stern and carried forward and wrapped loosely around a revolving cathead. As the crew hauls in the two wings simultaneously by hand, one or two men bring the purse line aboard with the aid of the power driven cathead. By the time the wings are in, all the purse rings and the entire lead line are aboard. The fish can not escape now unless they split the net by sheer force of weight. The mesh and corks of the greater part of the bag are then brought aboard, sometimes with the aid of the winch. The fish are thus concentrated in the reinforced part of the bag known as the landing bag or sack. They are then brailed aboard the boat with a scoop net which is suspended from the boom.

All types of encircling nets can be used for mackerel fishing either in the daytime or at night, although a somewhat different technique is used in locating and catching the fish at night. When scouting in the daytime the fishermen watch for fish jumping, which they often do in the early morning. Other indications are dark patches of water denoting masses of fish, or flocks of sea birds feeding on bait that the mackerel have driven to the surface. When fished for at night the schools are betrayed by the luminescence given off by the many minute organisms the fish disturb in their movement through the water. Schools encountered in daylight fishing seem to be less compact than those found at night, so the daytime fishermen have to use chum or toll bait to bring the fish together. Before and while circling and while pursing, the fishermen throw quantities of either ground-up fish or live bait into the water. This not only causes the greedy mackerel to congregate, but distracts their attention from the net that is impounding them. When fishing at night, chum is seldom used but scares must be employed to keep the fish from escaping under the boat before the net is pursed. The fishermen sometimes throw rocks into the water or move poles and paddles up and down. A submerged blinking electric light is the most effective scare.

The Lampara Boat Prior to 1928

Prior to the development of the mackerel canning industry, the lampara type boats had been used for sardine netting, hook and line albacore fishing, and general market fishing. The mackerel was among the least important species taken.

The Italian boats fished with lamparas exclusively until 1926, when the ring net was adopted by some of the boat owners. The Italian lampara boats fished for various fresh fish market species, such as barracuda, white sea-bass, yellowtail, kingfish and smelt, during the greater part of the year. In the winter, during the sardine canning season, they devoted most of their attention to sardine fishing.

Similarly, the Japanese boats used their round haul nets for sardines in the winter months. During the remainder of the year, however, they fished with hook and line for albacore, skipjack, yellowfin tuna, barracuda and yellowtail. They used small live sardines and anchovies for bait. The net used for catching the bait was a slightly modified round haul net.

During the early years of the sardine fishery, the small boats, employing lamparas, accounted for practically all the sardines taken in the San Pedro region. However, large boats using purse seines entered the sardine industry during the 1925-26 season.[6] The purse seine fleet, which was engaged in the tuna and market fisheries, had expanded too rapidly and literally overflowed into the sardine fishery. It was soon demonstrated that the purse seine was a far more effective net for sardines than the lampara, and moreover the larger boats could carry much heavier loads. Within a short time the little lampara boats had been crowded into the background. In order to compete with the purse seine, the small boat fishermen developed the ring net. This new net proved to be more efficient than the lampara and by using it the small boats were enabled to remain in the sardine fishery, although the purse seiners with their greater carrying capacity were destined to dominate the industry. As the advantages of the larger boats became evident, many small boat fishermen tied up their boats and obtained purse seiners, either by purchase or charter.

Not only had the purse seiner all but driven the lampara boat out of the sardine fishery by 1928, but other factors were operating that tended to decrease its usefulness in other fisheries. For one thing, legal restrictions on the use of circle nets for the more important species of market fish handicapped the boats to some extent. Also, several poor years of local tuna and albacore fishing discouraged the small boat fishermen. Consequently, the lampara boat, as a class, seemed ready for the discard. Many were actually tied up permanently or sold and converted into pleasure boats.

The Lampara Boat During the Early Years of the Mackerel Fishery

The canners who started packing mackerel late in 1927 and in 1928 realized that the regular mackerel hook and line boats could not possibly furnish enough fish to keep their canneries running. On the other hand, their purse seiners were busy with sardines at the time, so they turned to the lampara boats for mackerel. At the time, the owners of the idle lampara boats were only too glad to offer their services. These small net boats proved to be ideal for cannery mackerel fishing. The fish were abundant close to San Pedro, well within the scouting range of the lampara boats. The capacity of the canneries was not great enough to handle the quantities that the fleet was capable of delivering; consequently they had to set low boat limits to avoid overloading their plants, *i.e.*, instructed the boats not to bring in loads in excess of certain specified amounts. The low limits naturally favored the small boats and not many purse seiners bothered fishing for mack-

[6] There had been earlier attempts at sardine purse seining in southern California (1893, 1898, 1919, 1921) but they were not particularly successful. Two purse seiners commenced sardine fishing in January, 1925, and were so successful that by the following season, 33 purse seine boats were operating (Fry, 1930.2 and Scofield, 1926).

erel even when there were no sardines or tuna to be had. At times, when limits were lifted, purse seiners fished for mackerel temporarily. Hook and line boats also fished for the canneries but their catches were of minor importance.

On the whole, it can be said that the lampara boat dominated the mackerel fishery during 1928 and 1929. Exact figures are not available on the proportions of the catch delivered by each type of boat during these years, but an examination of the cannery catch for May, June and July, 1929, shows that lampara boats accounted for 74.4 per cent of the landings during that period, which is probably representative of the first two or three years of the fishery. Purse seiners took 19.4 per cent and hook and line boats of all kinds took 6.2 per cent of the catch during this period. The average size of load for the lampara boats during the summer of 1929 was 6306 pounds.

Some of the lampara boats still used lampara nets in 1928, but by 1929 all the boats of this type in the San Pedro region had adopted ring nets. Lampara nets have not been used since 1928 for regular cannery mackerel fishing. A few boats fishing for the wholesale markets use lamparas for various species of small fish including mackerel. They occasionally sell excess catches at the canneries, but those are the only times that lamparas figure in the cannery fishery at San Pedro proper. At Newport a few boats still fish for mackerel with lamparas (1937). These lamparas are bait nets, sometimes slightly modified for mackerel and sardine fishing.

The Lampara Boat During the Period 1931-1934

During the depressed period of the mackerel fishery, 1931 and 1932, lampara boats supported the industry almost altogether. Of all the mackerel landed commercially in the San Pedro region during 1931, 77.5 per cent was caught by lampara boats. In 1932 the share of the lampara craft was 80 per cent. (See Tables 1 and 2.)

Prices paid for mackerel at the canneries were so low ($8 to $10 a ton) during 1931 and 1932 that hook and line boats were not interested in cannery fishing. They could not afford to sell their 200 and 300-pound catches for a half cent a pound. In fact, wholesale market prices were so low that many set liners did not fish for them, either. On the other hand, the canneries set such low limits for their boats that purse seiners could not afford to operate. A five-ton limit, at $8 a ton, for a 50-ton boat with an 11-man crew left no margin for

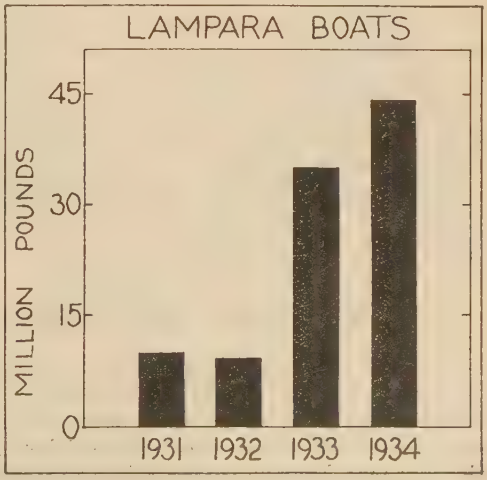

FIG. 9. Annual mackerel catches of lampara type boats in the Los Angeles region, 1931-1934.

profit. Hence the lampara boats dominated the fishery. They made no money at the fishery but were able to meet expenses and thus survived.

The average size of catch for the lampara boats in 1931 was 9483 pounds. In 1932 the average load had dropped to 7293 pounds, due in some measure at least to low boat limits.

Thirty-nine lampara boats operated in the mackerel fishery during 1931. Of these, 21 fished more or less regularly, that is, made more than 20 deliveries. In 1932 there were 33 lampara boats in the fishery, of which 24 can be classed as consistent. (See Fig. 10.)

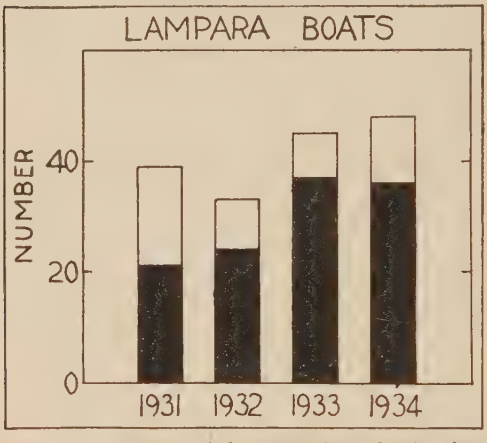

FIG. 10. Number of lampara type boats that fished each year for mackerel in the Los Angeles region, 1931-1934. Solid squares indicate number of boats that fished regularly (*i.e.*, made more than 20 catches during the year in question); white squares indicate boats that made occasional landings.

With the expansion of the industry in 1933, the catches of the lampara boats more than trebled. (See Fig. 9.) A further increase took place in 1934. However, all other types of boats increased their activities, so the percentage of the total catch taken by lampara boats dropped. With the market clamoring for canned mackerel, the packers expanded their capacities, raised prices and removed all boat limits. Consequently all available boats entered the fishery and shared the catch. The lampara boats still accounted for over half of the catch in 1933, with 59 per cent. In 1934, they took but 45.5 per cent. However, they still led all other types of boats. Most of the percentage loss was due to the activities of the purse seine fleet which had increased its share of the catch from 8 per cent in 1932 to 42.5 per cent in 1934.

With boat limits removed, the lampara boats were able to make greater daily catches. Deliveries averaged 11,706 pounds in 1933 and 14,572 pounds in 1934.

The numbers of lampara boats in the mackerel fleet reached their peak in 1933 and 1934. Forty-five fished in 1933, of which 37 made more than 20 landings each. In 1934 there were 48 lampara boats in the fleet, of which 36 fished regularly.

The Lampara Boat During the Period 1935-1937

Since 1934 the lampara boat has diminished in importance. It became apparent during 1934 that the larger purse seine boats were better adapted to large scale mackerel fishing operations, and just as some years before in the sardine fishery, the purse seiners supplanted the lampara boats. In 1935, lampara boats were fairly active, in 1936 a few still fished, but in 1937 there were practically none left in the

fishery. One or two of the larger ones have persisted, but all the smaller ones have dropped out of the mackerel fishery.

The owners of the lampara boats have nearly all chartered, purchased or built purse seiners, so the same fishermen are still operating—but operating on a larger scale. Most of the Italian lampara boats have been sold to San Diego fishermen, as small boats are still important at that port. The former owners have all built large boats so there is an entirely new fleet of Italian ring net boats, all of purse seine design. The owners of Japanese boats have chartered purse seiners from Washington and Alaska, bought old purse seiners or built new boats. They now use their small boats for live bait fishing almost exclusively. The recurrence of albacore runs since 1934, a tuna run in 1936, and a skipjack run in 1937 have revived the old-time live bait fishing, so it is evident that the Japanese boats have not entirely outlived their usefulness.

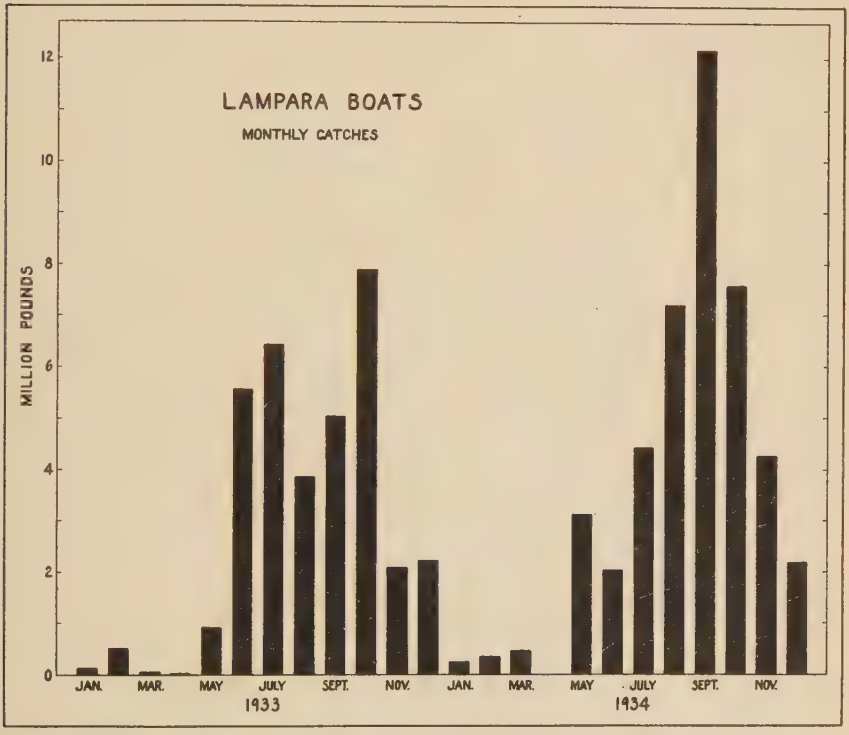

FIG. 11. Monthly mackerel catches made by lampara type boats in the Los Angeles region, 1933-1934. Note that catches are greatest in the summer and fall when mackerel are available in the greatest numbers.

Seasonal Catches of Lampara Boats

When the canneries are operating at capacity and want all the fish they can get, the monthly catches of lampara boats are a good indication of the abundance of mackerel throughout the year. Their monthly landings for 1933 and 1934 are shown in figure 11. Study of this figure indicates that mackerel first become available in quantities

during May and, in general, increase in abundance during the summer until about October. Every summer there are shorter or longer periods of scarcity. For example, mackerel were rather scarce during part of August in 1933. In June, 1934, mackerel were very hard to catch and many net boats installed bait tanks and tried to catch them by fishing with hook and line. (See section on striker boats, p. 38.) During November and sometimes in December, mackerel are still abundant, but with the sardine season opening in November the canners divert most of their boats to that fishery, so mackerel catches drop. Every year some time after Christmas the mackerel become very scarce. The time of disappearance may be during December, January or February, but whenever and wherever they go, they stay away until about the middle of May. April is always the month of least abundance.

PURSE SEINE BOATS

Description of Purse Seine Boat

Purse seine boats are wider, deeper and more heavily constructed than lampara boats. They are designed to carry most of their load in the hold rather than on deck like the lampara boats. The purse seiners that fished in 1934 ranged from 56 to 75 feet in over-all length. (See Fig. 13.) Net tonnages varied from about 25 to 60. The smallest boat in the purse seine fleet has a net tonnage of 18. The boats in use in 1934 could carry anywhere from 20 to 100 tons of fish in the hold. Total capacities, including deck loads, ranged from 60 to 140 tons. Many of the boats fishing in 1934 were built during the purse seine boom of 1918-1919. At that time, 65-footers were most popular. A new wave of purse seine building commenced in 1934, and many new boats soon entered the mackerel fishery. Most of these are 70 to 85 feet long. Total capacities for the new boats, including hold and deck loads, range from 85 to 200 tons of mackerel.

The purse seine fleet consists of a number of different kinds of boats which can be grouped into various categories. Some of the boats fish principally for mackerel and catch other fish only incidentally. Others fish for tuna in the summer and sardines in the winter, catching mackerel only incidentally. Some of the boats fish with ring nets and some with turntable purse seines. Some boats are old and small, and are operated by inefficient crews that can not obtain better boats. Some are new and large, operated by good fishermen. Some boats are owned by Alaskan or State of Washington fishermen who come south to fish. Many northern boats are chartered by local crews and only the captains or engineers come south. A number of boats are owned by the canneries or mortgaged to them. Some are owned outright by local and Monterey fishermen. Some of the crews are Japanese, some Italian and some Slavonian—a very few are of other nationalities. Each racial group tends to fish differently, so it is not unusual to see the whole Japanese fleet come in loaded whereas all the Italian boats missed—or just as frequently it is the other way around.

The purse seiners, being larger and with sleeping accommodations for their entire crews, can go farther afield in their search for fish than the lampara boats. Consequently, they are more successful when the schools of mackerel are far from port. However, with their larger crews (10 to 15 men) they must obtain greater loads to show a profit. Since 1933, when boat limits were removed, the purse seiners have been more and more of a factor in the mackerel fishery until now they dominate it (1937).

Description of Nets Used on Purse Seine Boats

The purse seiners use two similar types of nets in mackerel fishing—ring nets and purse seines.

The ring nets in use are the same as those employed on the lampara boats, except that they are much larger. The ring nets used on the larger boats range from 200 to 350 fathoms or more in length and 30 to 50 fathoms in depth. In general, it can be said that the larger the boat the larger the net. Exactly the same fishing methods are used by

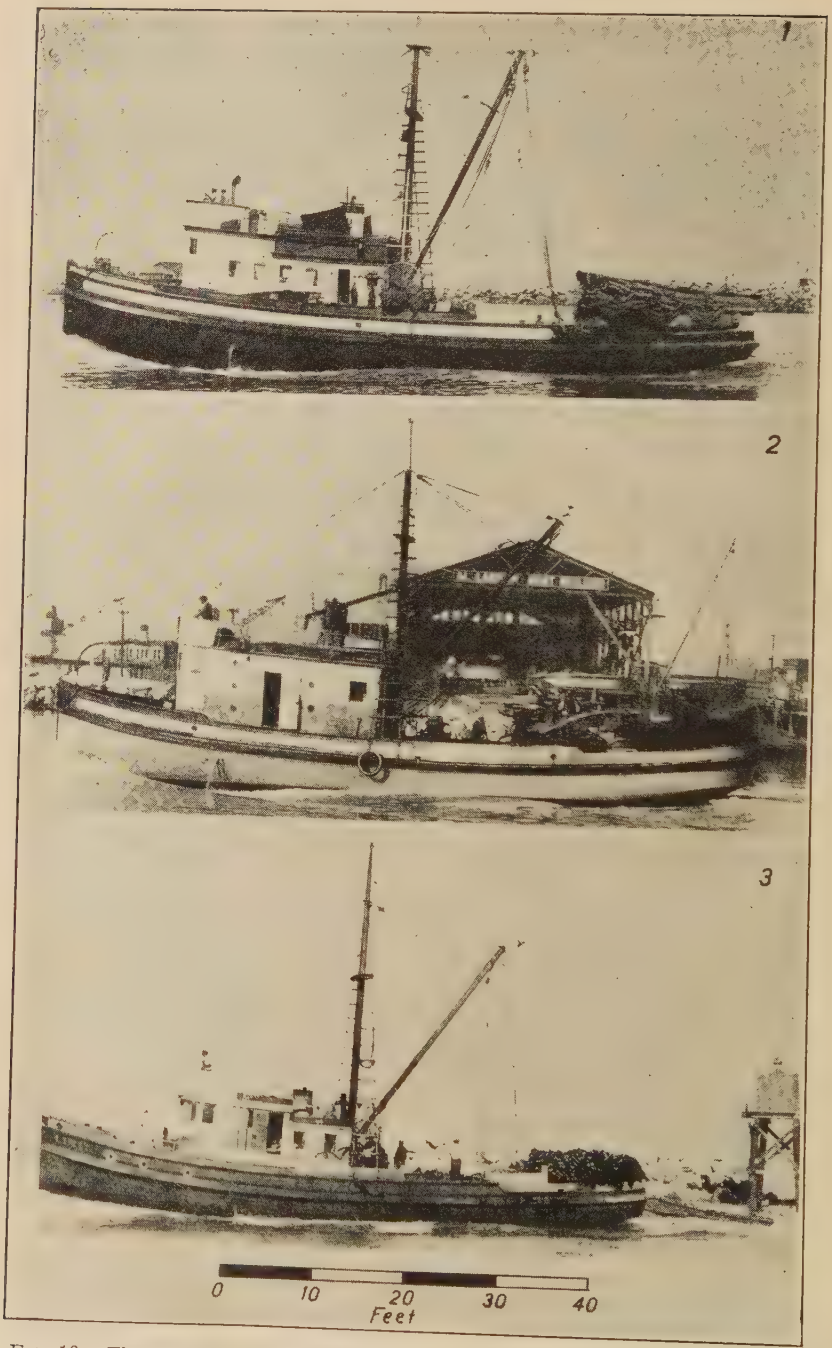

FIG. 12. Three purse seine boats. *1* is a large boat with a turntable and purse seine. *2* is a large boat with ring net. *3* is a smaller boat with a ring net. Photographs by D. H. Fry, Jr., at San Pedro.

the large boats and the small ones. For the most part, ring nets are used by Japanese and Italian fishermen, and purse seines are used by the Slavonians.

Purse seines are similar to ring nets. The principal differences are that the purse seine is more heavily constructed, has fine mesh throughout (instead of coarse mesh in the wings) and is cut square at the ends (instead of tapering). As a preservative measure, purse seines are either tarred or tanned, or both. A purse seine is carried at the stern on a revolving platform or turntable equipped with a power roller. The net is played out over the roller at the stern as the boat circles. Then the turntable is turned so the roller faces the circled net, and the net is hauled over the roller, from one end only so the fish are concentrated in the landing bag at the other end of the net. Thus, in operation, the purse seine differs from the typical ring net in that it is hauled over the side of the boat (instead of the stern) and on one end only (instead of both ends simultaneously). Mackerel purse seines and sardine seines used for mackerel range from 180 to 250 fathoms in length.

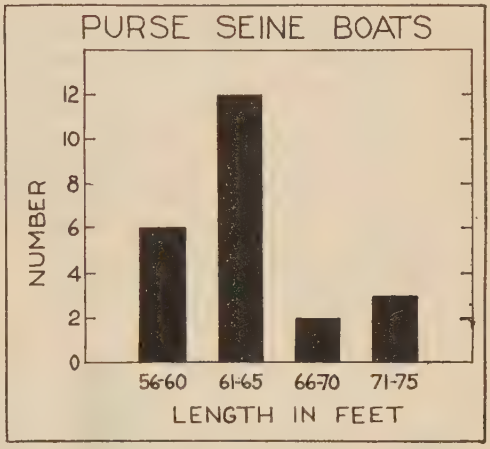

FIG. 13. Lengths of the 23 purse seine type boats that fished regularly for mackerel at San Pedro in 1934. Net tonnages of these boats range from 18 to 62, with most of them from 30 to 40. Some of these boats used ring nets and some fished with turntable purse seines.

Some ring nets are built with the bag at one end. They are used with a turntable and operate like a purse seine.

The chief advantage of the turntable nets is that they require less work from the crew—the power roller and boom do most of the pulling. Consequently purse seine crews generally carry a few less men than ring net crews. Ring nets, on the other hand, are faster in action, so more hauls can be made in a day.

The Purse Seine Boat in the Mackerel Fishery Prior to 1931

Purse seiners were of minor importance during the early years of the mackerel fishery, for the reasons outlined in the section on lampara boats. Such catches as they made were incidental to sardine and tuna fishing. In the fall of 1930, purse seiners held the spotlight briefly when two canners sent their fleets of large boats out for mackerel before the boats would be needed for sardine fishing. These boats were very successful, and the eight of them caught 3,090,000 pounds in just a few weeks. Although held down by low limits, they averaged 25,971 pounds to the delivery. During the same period, the 19 lampara boats available to these canneries were able to catch only 2,394,000 pounds, or 13,302 pounds per trip. It was thus seen that when it was essential

to have large quantities of mackerel caught in a short time, the purse seine boat was more effective.

The Purse Seine Boat During the Period 1931-1934

During the next two years there was no need to obtain large quantities of mackerel at any time, so the purse seine fleet lay idle as far as that fishery was concerned. The bottom had dropped out of the mackerel market, and the few orders that came in could be taken care of by the lampara boats. Roughly speaking, the purse seiners took 9.5 per cent and 8.5 per cent of the total catches in 1931 and 1932, respectively. That amounted to about 1,000,000 pounds a year, a figure to be exceeded in a single day a few years later.

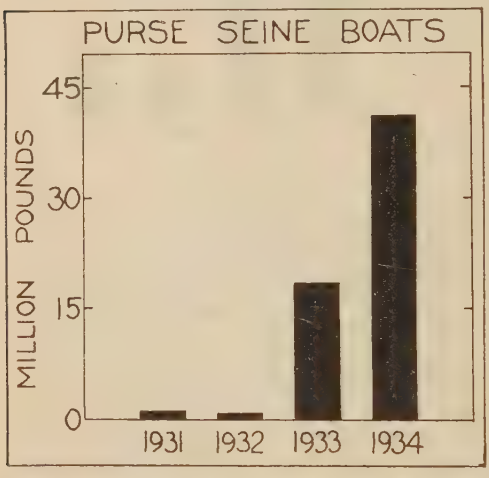

FIG. 14. Annual mackerel catches of purse seine type boats in the Los Angeles region, 1931-1934.

In 1933 the mackerel industry underwent a tremendous expansion. Boat limits were removed, except in a few occasional instances, and purse seiners could fish as much as they wanted. Landings made by purse seine boats jumped to 18,660,000 pounds, which was 31.7 per cent of all the mackerel taken that year. Thirty-three purse seiners caught mackerel in 1933. Of this number, 13 fished regularly.

By 1934 the canneries had increased their capacities and more purse seine boats entered the fishery, so the catches made by purse seiners rose still further, to 41,278,000 pounds. This figure represented 42.5 per cent of the total mackerel catch for 1934. During this year, 69 purse seiners landed mackerel in the Los Angeles region. Twenty-three of these fished consistently; the others made a few incidental deliveries of mackerel caught while sardine fishing. The average size of load was 29,213 pounds, just double that of the lampara boats.

It had become evident that the purse seine type of boat was the boat of the future. Lampara boat and live bait boat owners began to buy, build or charter purse seiners and leave their small boats to fishermen who had not the foresight nor capital to procure larger boats.

The Purse Seine Boat During the Period 1935-1937

The mackerel industry continued to expand in 1935 and the purse seine fleet shared in the expansion. As the fleet of purse seiners grew larger, more and more lampara boats dropped out until before the season ended the purse seiner was far and away the more important of the two types of boats.

In 1936 a scarcity of mackerel first became apparent to the industry as a whole. The drop in boat catch (catch per unit of effort) that occurred in 1935 was overlooked because the *total* catch increased due to more intensive fishing (Fry, 1937.2). But in 1936 with an augmented purse seine fleet fishing intensively, the total catch slumped. (See Figs. 2 and 4). By then there were scarcely any lampara boats making any effort to remain in the fishery. The purse seiners were supporting the industry alone and when they could not find enough fish there was no use calling on the small boats.

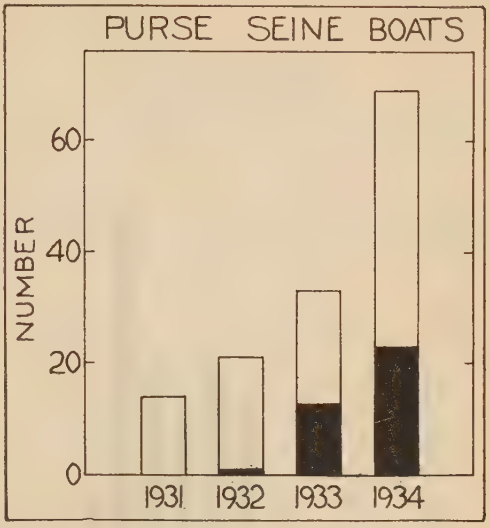

FIG. 15. Number of purse seine type boats that fished each year for mackerel in the Los Angeles region, 1931-1934. Solid squares indicate number of boats that fished regularly (*i.e.*, made more than 20 catches); white squares indicate boats that made occasional landings.

In 1937 the lampara boat had all but become a thing of the past. Practically all the catches made were taken by purse seiners. The season was very disappointing as landings were far below the industry's expectations. However, the purse seiners kept at it, and whenever fish were available they caught them.

At present it appears as if the purse seine boat will be the most important type of boat in the mackerel fishery for some time to come. However, if mackerel ever get so scarce as to become a high priced fish, available only in small quantities, it may be that the lampara boat will become dominant once more as there will be no need to use large boats to catch small schools.

Seasonal Catches of Purse Seine Boats

Purse seine boats make their best mackerel catches at the same seasons as the lampara boats. The two types of boats fish in the same manner and consequently can be expected to have similar success from month to month. Comparison of figures 16 and 11 shows that purse seiners and lampara boats have similar ups and downs in the fishery, in fact, the trends are identical—only the actual amounts caught differ.

The same two factors affect both types of boats—availability of mackerel and competition of the sardine fishery. If anything, the latter factor affects the purse seiners more than it does the lampara boats. For example, in 1933 the canners had most of their purse seiners fishing for sardines, so November and December mackerel catches were light. The construction of new canning lines in 1934 made it possible for some canneries to handle both sardines and mackerel simultaneously and in large quantities. Consequently they instructed

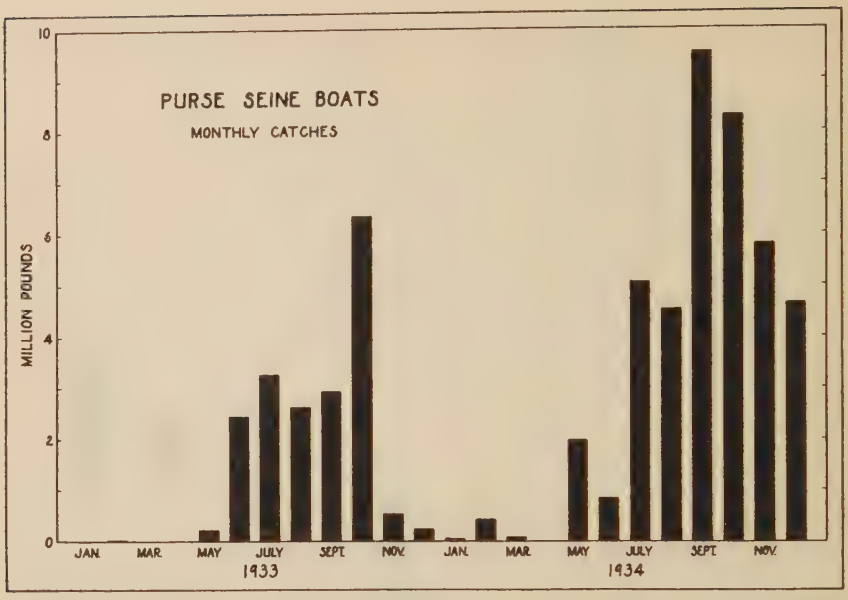

FIG. 16. Monthly mackerel catches made by purse seine type boats in the Los Angeles region, 1933-1934. Note that the seasonal landings of purse seine boats parallel the catches of lampara boats (see Fig. 11).

their boats to bring in whichever species they ran across first (with certain limitations after the memorable day on which the entire purse seine fleet brought in capacity loads of mackerel which flooded all the canneries). In 1934, therefore, mackerel catches were heavy for the months of November and December.

GILL NET BOATS

Description of Gill Net Boats and Gear

Gill netters have never been of any great importance in the California mackerel fishery, but some mackerel is taken by them every year. Usually these boats catch mackerel only incidentally while fishing for other, more expensive, species.

The gill net boats used at San Pedro are small craft, generally 25 to 45 feet in length. They carry crews of two or three men. All kinds of boats are used as gill netters. Many are lampara or live bait boats that fish with gill nets at certain seasons only.

FIG. 17. Hauling in a trammel net near San Pedro. This is a representative gill net type boat. Photograph by author, 1934.

Two kinds of nets are used in gill netting—the gill net and the trammel net. Both are designed to catch fish by entangling—the fish swims against the net, becomes tangled in it and can not escape.

The gill net consists of a piece of webbing of uniform sized mesh, with corks along one edge and weights along the other. It is placed in the water so that the corks support the upper edge and the weights hold the lower edge down—it hangs as a curtain in the water. The net can be set at any depth, from the surface to the bottom, by adjusting the weights and corks and by using anchors. The size of mesh depends on the species of fish sought. The mesh should be large enough for the fish to stick its head through, and small enough to keep its body from passing through. Once a fish has entered the net, its gill covers prevent it from backing out of the webbing, and it struggles forward until caught fast at the shoulder.

Gill nets are used in several fisheries in the San Pedro region. Coarse meshed nets for white sea-bass and fine meshed smelt nets sel-

dom catch mackerel, nor do the specialized nets used for flying fish. It is the barracuda net that takes mackerel. These nets are made of $3\frac{1}{4}$- to $3\frac{1}{2}$-inch mesh (stretched measure), usually $3\frac{3}{8}$-inch, which is just right for entangling medium-sized mackerel. Small mackerel swim right through the meshes and large ones can not poke their heads in far enough to become entangled.[7] Consequently, from the standpoint of conservation, the barracuda gill net is a desirable form of gear for taking mackerel, in that it spares both immature fish and the largest breeding fish. Its principal disadvantage to the fishermen is that it can not catch mackerel in quantities great enough to make it worth while.

Barracuda fishermen usually set their nets where barracuda are plentiful and mackerel scarce, but even so they frequently catch a few mackerel. Sometimes when barracuda are hard to locate, the fishermen set deliberately for mackerel (and other species) so they will have some fish to bring ashore. Although barracuda gill nets are usually set out in a straight line, the fishermen sometimes set them in a circle. In this case, they circle a school of fish and then scare them into the net by throwing rocks and causing a commotion inside the circle. Circle gill netting is the more effective way of catching mackerel.

The trammel net, as used in southern California, consists of three curtains of webbing suspended from a common cork line. The middle webbing is of small mesh, loosely hung, the outer guard nets are tightly hung large mesh. A fish, striking either side, swims through the first webbing it encounters, hits the second layer, through which it can not pass, and pushes it through one of the openings in the third layer to form a sack in which it is trapped. The weight and struggles of the fish cause the open end of the bag to rest on the strands of the guard webbing which close it effectively.

Trammel nets are used almost entirely for catching halibut and sharks in the San Pedro region. The webbing used is too coarse to capture mackerel in any quantities, but occasionally one will become entangled in a halibut net. For all practical purposes the trammel net can be disregarded in a discussion of the mackerel fishery.

The Importance of the Gill Netters in the Mackerel Fishery

The gill netter can not be considered a factor of importance in the San Pedro mackerel fishery. Barracuda gill netters contribute small amounts of mackerel to the fresh fish markets every year, but there is no regular gill net fishery for mackerel. Gill net fishermen, who operate on a small scale, depend upon more expensive species of fish for their livelihood and catch mackerel only in an incidental way. The normal annual catch of gill net mackerel in the San Pedro region is less than 50,000 pounds. (See Fig. 18.) Only in 1933 did the landings amount to anything.

The small catch is divided among a considerable number of boats. For instance, the 1931 catch of 30,000 pounds was made by 35 boats, none of which made more than 17 deliveries of mackerel. The average size of their catches was 137 pounds. Thirty-eight gill net boats contributed to the 1932 catch of 37,000 pounds. The most consistent of these made only 19 deliveries. The average size of catch in 1932 was 158 pounds.

[7] From unpublished data on file at the California State Fisheries Laboratory.

The 1933 boom in mackerel fishing extended even to the gill netters and their catch reached 172,000 pounds. (See Fig. 18.) Several of the gill netters, finding the barracuda market dull, fished for the mackerel canneries during June and July of that year. These boats were equipped for catching mackerel at that time, the height of the barracuda season, and were glad to sell excess mackerel catches to the canneries. Later in the season these boats were equipped with ring nets or bait tanks and went mackerel fishing on a larger scale.

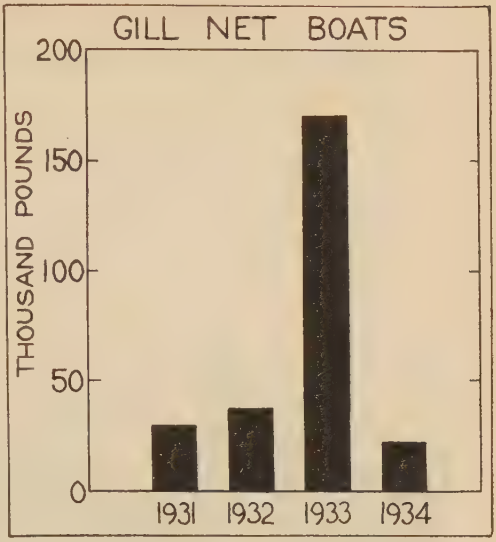

FIG. 18. Annual mackerel catches of gill net boats in the Los Angeles region, 1931-1934.

During 1933, gill netters to the number of 32 landed mackerel. Ten of these boats fished rather consistently. (See Fig. 19.) Catches were never large, even when the boats concentrated on mackerel fishing, and it became apparent that gill netters would not become an important factor in the mackerel fishery. Landings averaged 335 pounds in 1933.

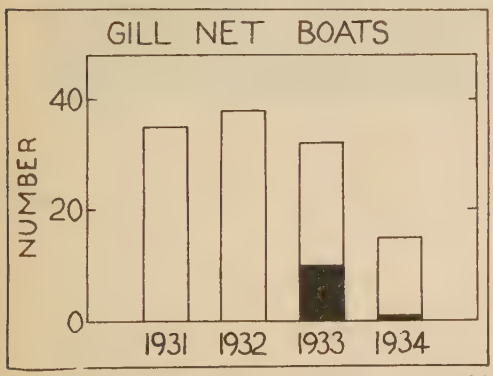

FIG. 19. Number of gill netters that caught mackerel each year in the Los Angeles region, 1931-1934. Solid squares indicate number of boats that made more than 20 catches each year; white squares indicate boats that made fewer landings.

By legislative action it was illegal to sell barracuda during May and June of 1934 (and 1935). Hence, gill net boats ceased operations during those two months. As that is the only time of year mackerel are taken by gill nets in any quantity, the catch dropped considerably in 1934. Only 15 gill netters landed mackerel in that year and their combined catches amounted to only 22,000 pounds.

The same conditions prevailed in 1935. Although we have not segregated gill net catches for that year, they were inconsiderable. Gill netting for barracuda was illegal during the months from May to August, inclusive, in 1936 and 1937, so there was even less incentive for mackerel gill netting in those years.

In summary it can be said that with the exception of two months in 1933, the gill netter has never been of any real importance in the mackerel fishery of southern California.

SET LINE BOATS AND SKIFFS

Description of Set Line Boats, Skiffs and Their Gear

The set liner has been an important factor in the San Pedro mackerel fishery since early days. Set lines and hand lines have always accounted for the greater part of the mackerel handled by the fresh fish markets, although these types of gear have never figured in the cannery fishery to any great extent.

The set line boats used at San Pedro are small craft that fish close to port, never staying out more than one day. They range from 23 to 35 feet in length. Most of them are of the typical "jig boat" type shown in figure 20. Those fishing out of Los Angeles Harbor are

Fig. 20. A typical San Pedro mackerel set liner—a 33-foot jig boat. Photograph by author, 1931.

manned principally by Japanese although there are a few Italian mackerel set liners. The Newport boats are operated by Scandinavians and Americans.

Skiffs and dories are employed to a considerable extent in the fisheries at Newport and Santa Monica Bay towns. These craft range in length from 12 to 18 feet. Some are powered by outboard motors, a few have inboard engines and many are propelled by oars only. Their principal occupations are lobster fishing and hand lining and set lining for mackerel and other fish.

For the purpose of this discussion all skiffs, dories and other row boats have been placed in the one category, "skiffs," which also includes a few assorted power boats less than 20 feet in length.

The skiffs and larger boats which are here classed as "set liners" employ three general types of gear: set lines, hand lines and troll lines.

Troll lines are not used to any extent in the mackerel fishery, catching mackerel only accidentally while fishing for other species such as barracuda and bonito. A troll line consists of a line with an artificial lure of feathers or bone towed behind a moving boat.

Hand lines are just what the name implies—lines held in the hand. A fisherman can operate one to three hand lines, each with one baited hook. The lines, of varying length, are lowered to the depth where the fish are feeding and are hauled in every time a bite is felt. The hand line is probably the simplest and most primitive gear in use in the mackerel fishery. It is not of great importance at San Pedro where set lines are more effective.

Mackerel set lines are more properly known as drift lines because they are not stationary but drift near the surface. The lines are about 1000 to 1500 feet long and carry 400 to 500 hooks. Several lines are usually set out, tied end to end. Weights at intervals along the line suspend it horizontally at the desired depth on buoy lines, to the upper end of which flag buoys and floats are fastened. As mackerel seem to feed at different depths from month to month, these drift lines can be set at the most effective depth. The number of lines used depends on the market demand. If the fisherman thinks he can sell more fish he uses additional lines. Thus, the catches made by these boats reflect market conditions rather than abundance of mackerel. During periods of scarcity the fisherman increases the number of lines, and during periods of abundance he decreases the number—depending on what he thinks he can dispose of at the markets. As a consequence, the set line boat can not be used in a study of mackerel abundance, unless the number of hooks used every day were known. This information is not available.

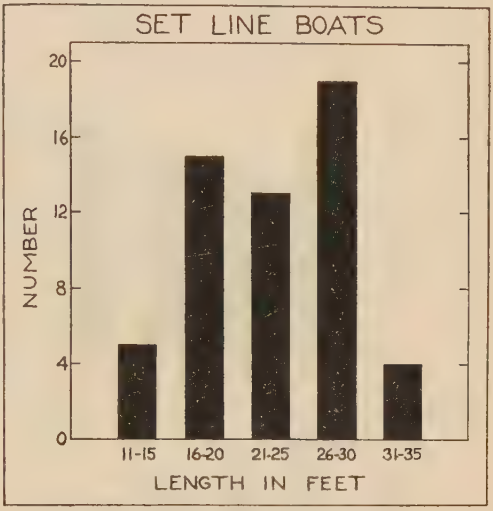

FIG. 21. Lengths of the 56 set line boats, skiffs and dories that fished regularly for mackerel at San Pedro in 1934.

Set Line Boats and Skiffs in the Mackerel Fishery Prior to 1931

In the days before mackerel canning became a large scale industry, set liners and skiffs were depended upon to supply nearly all the mackerel landed commercially; in fact they constituted the mackerel fleet. As soon as canning commenced, in 1928, it became evident that hook and line boats could not supply enough mackerel to keep the plants running. Consequently, net boats were brought into the fishery. The set liners continued to supply the wholesale markets with fish. As they could bring their catches ashore in better condition, due to more careful handling, the market men preferred to buy their fish. In addition, the set liners sold excess catches to the canneries, as the high prices then prevailing ($30 a ton in 1929) made it worth their while.

In 1930, cannery prices dropped, so the set liners ceased delivering to them. However, in the fall of 1930, one small specialty cannery wanted some first class line-caught mackerel and induced a dozen set liners to go fishing. These boats averaged only 462 pounds a trip, which showed that set lines could not take large quantities of mackerel even when there were no limits. Set liners fishing for the wholesale markets seldom bring more than 500 pounds ashore, averaging about 375 pounds a day. During 1928 and 1929, considerable quantities of mackerel landed at Newport were shipped by truck to San Pedro canneries. Much of this fish was caught by the "mosquito fleet" of small set liners and skiffs operating out of Newport. This town has always been the small boat center of the coast and here the mackerel fishery has always been dominated by the set liners, hand liners and live bait boats.

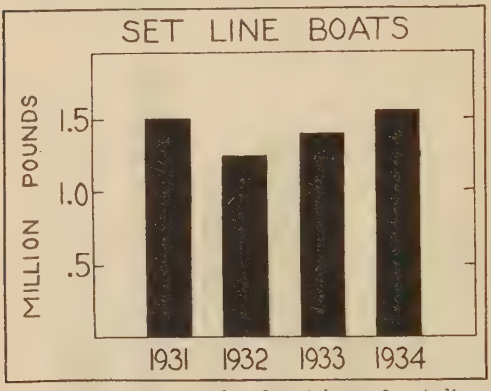

FIG. 22. Annual mackerel catches of set line boats (exclusive of skiffs) in the Los Angeles region, 1931-1934.

Set Line Boats and Skiffs During the Period 1931-1937

In 1931 and 1932 set liners and skiff fishermen came upon dark days. Mackerel prices were low and the markets had to set low boat limits. These boats fished only for the wholesale markets as cannery prices were far too low to pay their expenses. The canneries paid a half cent a pound for mackerel in 1931; the markets paid about two cents, on the average. Total catches for the set line boats were 1,514,000 pounds in 1931 and 1,250,000 pounds in 1932. (See Fig. 22.) The average size of load was 365 pounds in 1931 and 341 pounds in 1932.

During these two years, skiff fishing was also at low ebb. Skiffs caught 95,000 pounds of mackerel in 1931 and 80,000 pounds in 1932. As might be expected for such small craft, average daily catches were small; 163 pounds in 1931 and 129 pounds in 1932.

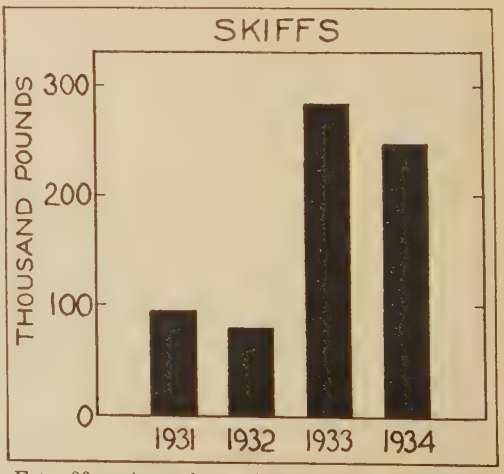

FIG. 23. Annual mackerel catches of skiffs (including all other types of boats less than 20 feet in length) in the Los Angeles region, 1931-1934.

The 1933 boom failed to affect the set liners to any great extent. For one thing the expansion was confined to the canneries; the wholesale markets witnessed no spectacular improvement in conditions. Hence, the boats fishing for the markets did not greatly increase their catches. On the other hand, nearly all set line boats that could be used for live bait fishing were converted into striker boats and left the ranks of the set liners. Their catches, therefore, must be counted in a different category. The 1933 mackerel catch of the set line boats was a little better than the preceding year's, amounting to 1,388,874 pounds. The average catch per trip, 359 pounds, was about the same as during the preceding years. In 1934, set line landings improved a little more as the catch reached 1,559,334 pounds. Average daily catches were higher (432 pounds) and less deliveries were made than in 1933.

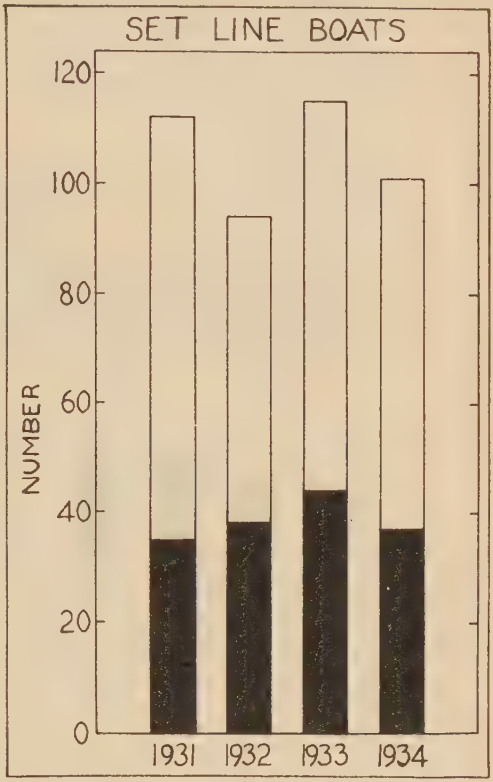

FIG. 24. Number of set line boats (exclusive of skiffs) that fished each year for mackerel in the Los Angeles region, 1931-1934. Solid squares indicate number of boats that fished regularly (*i.e.*, made more than 20 catches); white squares indicate boats that made occasional landings.

On the other hand, the cannery boom in 1933 affected the skiff catch markedly. When the canneries reopened on a large scale they again drew upon mackerel caught at Newport and hauled to San Pedro by truck. As soon as the Newport set liners saw their opportunity to dispose of large quantities of mackerel, they converted their boats for striker fishing which enabled them to catch more fish. The skiff fishermen, however, were not able to engage in striker fishing but they could use more lines and sell more mackerel. As a consequence of their increased activity the skiff catch rose to 283,532 pounds in 1933. The landings dropped a little in 1934 to 246,949 pounds. Average daily catches were 211 pounds in 1933 and 230 pounds in 1934.

The number of set line boats in the mackerel fishery did not vary much during the period 1931-1934. (See Fig. 24.) Every year there was a regular fleet of 35 to 44 boats (35 in 1931, 38 in 1932, 44 in 1933 and 37 in 1934). In addition there was always a large group of boats that made occasional deliveries of mackerel. The numbers of

these "incidental" boats varied from 56 (1932) to 77 (1931). More boats are represented in the set line classification than in any other.

Skiffs are much less numerous in the mackerel fishery than the larger set liners. The total number catching mackerel each year remained about the same for the four-year period: 57 in 1931, 42 in 1932, 52 in 1933 and 54 in 1934. Most of these landed mackerel only occasionally when fishing for other species. There was a steady increase in the number of skiffs that fished consistently for mackerel, from 9 in 1931 to 19 in 1934.

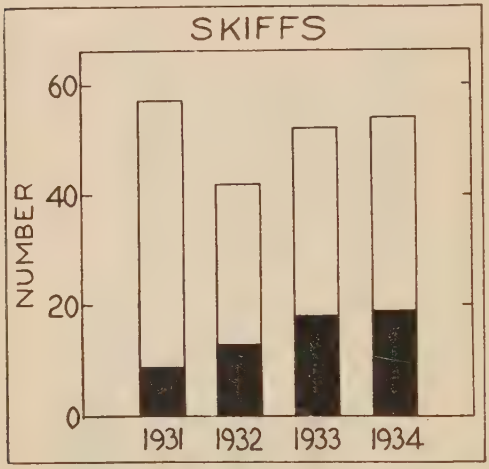

FIG. 25. Number of skiffs that fished each year for mackerel in the Los Angeles region, 1931-1934. Solid squares indicate number of boats that fished regularly (*i.e.*, made more than 20 catches); white squares indicate boats that made occasional landings.

Although we have not segregated the catches of set liners and skiffs for the years since 1934, we have every reason to believe that there has been no great change in their situation. Set liners continue to bring in mackerel to the wholesale markets as of old. Skiffs continue to land small quantities of mackerel at Santa Monica Bay ports and still deliver cannery loads at Newport. Beginning with 1935 there have been three canneries at Newport, so the local boats now unload at the canneries instead of into trucks. The establishment of these canneries has been a boon to the small boat fishermen as they are now assured of selling all the mackerel they can catch; the trucks operated only when mackerel were running in large quantities and did not bother with small scattered loads.

Seasonal Catches of Set Line Boats and Skiffs

The set line fishery is not as seasonal by nature as the various net fisheries. There seem to be always enough mackerel present in local waters to suply the wholesale markets; during periods of scarcity the addition of more lines suffices to keep the catches up. Monthly landings depend upon two related factors: how much mackerel the markets want, and what other species are available to the set line boats.

A study of figure 26 shows that the largest catches are made in the winter months. From December to March mackerel set lining is heaviest, the landings of these four months comprising 47 per cent of the annual catch. Incidentally, this is the period during which mackerel are scarcest, which indicates that abundance is not the controlling factor in the line fishery. It is during the winter that higher priced, more desirable market fish are all but absent from local waters; the markets must depend to a large extent on mackerel to fill their orders, and likewise with little else to fish for, the set liners are glad enough to

go mackerel fishing. Beginning in April, barracuda, white sea-bass, yellowtail and other high priced fish make their local appearance, to remain all summer. Neither markets nor boats can be bothered with

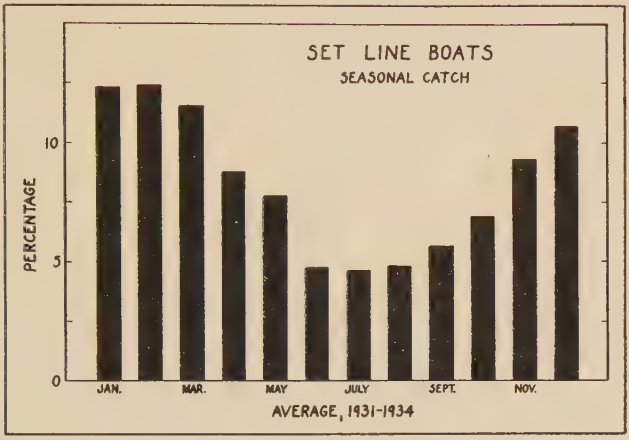

FIG. 26. Seasonal mackerel catches of set line boats, including skiffs, in the Los Angeles region; average monthly landings, 1931-1934, inclusive. Note how closely the set line season follows the season at the fresh fish markets (see Fig. 6).

low priced mackerel until the fall when the more desirable species leave local waters. Another point to be considered is that mackerel spoils readily so that it is very hard to handle during the hot weather prevalent in the summer. However, as there is a steady demand for low priced fish of all sorts, some mackerel is sold every month of the year.

STRIKER BOATS

Description of Striker Boats and Fishing Methods

Striker fishing is a fairly successful method of capturing mackerel by means of hook and line. It is known as live bait fishing and "Jap-pole" fishing.

Striker fishing can be done from any kind of boat although it is not very profitable on boats less than 25 feet long as they can not carry large enough loads.[8] Most of the striker boats used in the mackerel fishery are old time albacore boats (see Fig. 27), similar in every respect to lampara boats except for the gear carried. The most popular

FIG. 27. Live bait striker boat. This boat is similar to the lampara type boat except that bait tanks and poles replace the ring net. Photograph by author.

size is 35 to 40 feet, total length. (See Fig. 28.) Boats of this size are just a little too small for net fishing but are admirably suited to striker fishing. The boats are manned by all nationalities of fishermen, with Japanese and Americans predominating. Scandinavians and Russians are to be found on striker boats, but Italians and Slavonians on the whole do not take to this kind of fishing. (San Diego Italians are great striker fishermen but San Pedro Italians fish almost altogether with nets.) The size of crew varies from two to six or seven men.

The success of striker fishing depends upon the voracity of the mackerel. Briefly the idea is to get the fish excited by feeding them chum (toll bait) and then catching them on artificial lures bearing barbless hooks.

[8] Occasionally, when mackerel are biting particularly well, small boat and skiff fishermen use poles and strikers to augment their set line and hand line catches. It has not always been possible to separate these occurrences from the usual set line catches, with which they have been included in this study.

Striker boats, also called bait boats or chum boats, carry bait nets for catching their chum bait. The nets are somewhat modified, fine meshed lamparas. The larger boats, and some of the small ones, are equipped with bait tanks to keep the bait alive. The bait consists of small sardines and anchovies, caught each morning before actual mack-

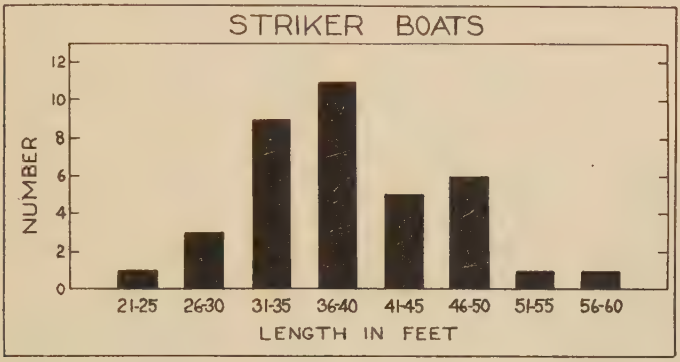

FIG. 28. Lengths of the 37 striker boats that fished regularly for mackerel at San Pedro in 1934.

erel fishing commences. Often mackerel are attracted most readily by throwing live bait into the water, hence the bait tanks. Sometimes ground-up fish makes better bait, so all boats carry meat grinders. The boats without bait tanks must perforce always use ground chum. When bait is scarce, some of the mackerel are saved to be ground up as chum the next day. The boats which have no bait nets use only mackerel as chum unless they can beg or buy sardines from other boats or from the canneries.

The fishing gear is very simple. It consists of a short bamboo pole, a short line, a wire leader and a feather lure (the striker) with a barbless hook.

When a likely spot is located, the boat is slowed down and one man begins to throw chum into the water. If and when mackerel come to the surface and begin to feed wildly on the bait, fishing commences. With one man continuing to chum, the others wield poles. The strikers, also called squid or picaroos, are moved about in the water in such a way as to resemble small fish. When a mackerel seizes the lure it is flipped into the air, off the barbless hook and onto the deck all in one motion—in fact the hook is often back in the water before the fish has hit the deck. Mackerel become so excited in their feeding that they lose all fear and take the hook readily. One fisherman can catch several hundred fish an hour when fishing is good. Striker fishing is usually carried on in the daytime, mid-day being the best. During the winter of 1937-38, however, it was found that night fishing is sometimes effective—a combination of a bright light and chum bait is used to attract the fish to the boat.

Some fishermen, no doubt becoming impatient at catching mackerel one at a time, devised a new way of catching them—the dip net, which appeared in the mackerel fishery during 1933. Unbelievable as it may seem, mackerel can actually be scooped out of the open ocean in a

hand-operated dip net. The dip nets are used on the striker boats as supplements to the poles. The typical scoop net (see Fig. 30) is made of coarse chicken wire mounted on a long handle. The hoop is 20 to 30 inches in diameter. When the mackerel are chummed up it is possible to make a swoop into the school and get anywhere from 3 to 40 fish at a time. The net is most effective for catching the smaller individuals of a school, the ones that are too small to take the hooks. Scooping is man-killing work; some of the larger nets operate off the winch but they are a bit cumbersome.

FIG. 29. Mackerel striker fishing near San Pedro. When the fish is in mid-air, the fisherman slackens the line, whereupon the fish comes loose from the barbless hook and sails on, to land on the deck at almost the same instant the hook returns to the water for another victim. Photograph by author, June, 1934.

As the striker boats use both lines and dip nets simultaneously it is impossible to segregate the catches made by the two forms of gear. Hence, in this report, all fish taken by the striker boats is lumped together and treated primarily as line-caught fish. As a matter of fact the hooks account for more fish, as they are effective when the mackerel are not bunched enough to make the use of a scoop net possible.

Another complicating factor enters the discussion of the striker boats. At times, usually in the early summer, when mackerel are hard to catch in nets, the large net boats engage bait boats to help them with their fishing. The bait boat chums up a school of mackerel with either ground or live bait, but does not attempt to catch any of the fish. While the bait boat is thus engaged in distracting attention of the mackerel the large boat sets its net around fish, chum boat and all. After the net is pursed, the small boat goes over the cork line out of the net. The seiner keeps two-thirds of the mackerel thus caught and gives the chum boat one-third. Sometimes the large boat actually carries all the fish ashore, and upon delivery one-third is credited to the chum boat. Sometimes, of course, it is not possible to chum up enough fish to make a set of the net worth while. In that case, the bait boat fishes with strikers. Because "chumming" is very intermittent and

not always actually carried on when intended (when the two boats miss connections or the mackerel will not school) it was found virtually impossible to separate the loads of striker boats into net-caught and line-caught categories. Consequently, the loads of the striker boats, as discussed in this report, consist of mackerel caught in three ways: on pole lines, in dip nets and in seines after heavy chumming.[9]

FIG. 30. Mackerel striker and dip net fishing near San Pedro. The fisherman using a pole is beating the water to attract the mackerel—the thrashing is in imitation of feeding fish. The dip net fisherman is poised, ready to make a scoop. Photograph by author, June, 1934.

The Striker Boat in the Early Days of the Mackerel Fishery

Striker boats played an important part in the development of the mackerel canning industry in 1928. Prior to that time live bait mackerel fishing was of no great importance, being a sideline to fishing for other species. With the expansion of the fishery when canning commenced, every conceivable type of boat was pressed into service to catch mackerel. There were a good many small bait boats lying idle because of the failure of the albacore fishery upon which they depended. These boats naturally turned to mackerel striker fishing, and all during

[9] Occasionally striker fishermen have to resort to the use of hand lines when the mackerel will not come to the surface, although they usually abandon the scattered schools altogether. Hence, a few hand line fish are included in the "striker boat" category.

1928 and 1929 were of considerable importance to the mackerel fishery. It became obvious to the live bait fishermen, however, that ring nets were more effective than strikers; consequently all of them who could afford ring nets—and had boats large enough to use them—purchased nets. As a result, by 1929 the striker boats had decreased in numbers

FIG. 31. Mackerel striker and dip net fishing near San Pedro. The man with the dip net has just scooped up several mackerel. Photograph by author, June, 1934.

and importance. During May, June and July of 1929, hook and line boats of all kinds delivered 1,084,000 pounds of mackerel to San Pedro canneries. This figure amounted to 6.2 per cent of the total catch for that period. Most of the hook and line boats at that time were striker boats, but some of the catch must be attributed to set liners.

In the early summer of 1930, the market for canned mackerel broke and the packers ceased production. When canning was resumed, on a small scale, in October, 1930, the price for fish had dropped from

$30 a ton to $10 a ton. At that low figure, hook and line boats could not operate as their small catches would not bring enough to pay for operating expenses. As a consequence there was no mackerel striker fishing to speak of from July, 1930, until May, 1933.

The Striker Boat During the Period 1931-1934

As noted above, there was very little striker fishing for mackerel during 1931 and 1932. The catches for those years were 9,135 pounds and 11,737 pounds, respectively.

When the canneries reopened on a large scale in May, 1933, striker boats once more figured in the fishery. Although the price for mackerel was still only $10 a ton, operating expenses were lower than in 1930 so small scale fishermen could afford to operate.

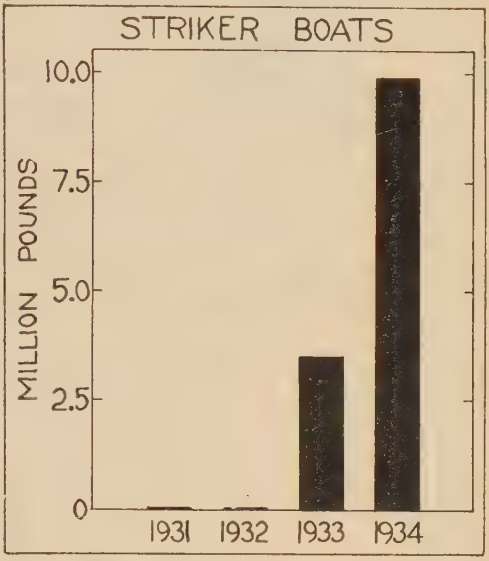

Fig. 32. Annual mackerel catches of striker boats in the Los Angeles region, 1931-1934.

Although only seven striker boats fished with any consistency during 1933, the striker catch amounted to 3,517,934 pounds or 6 per cent of the total mackerel catch. (See Fig. 32 and Table 3.) In addition to the seven regular boats, 24 others made occasional landings. (See Fig. 33.) Many of these were Newport boats that either brought their fares to San Pedro or landed them at Newport for trans-shipment by truck to the San Pedro canneries.

The striker boat reached the peak of its importance in 1934. In that year the catch of the bait boats amounted to 9,865,430 pounds, in spite of the fact that a small but exciting albacore run diverted a number of boats from the mackerel fishery for a time. The striker catch in 1934 represented 10.2 per cent of the total mackerel landings in the San Pedro region. During 1934, the striker boats fishing regularly for mackerel numbered 37. A slightly greater number, 39, made occasional landings. Striker boat catches averaged 4832 pounds per load in 1933 and 4214 pounds in 1934.

Striker fishing during 1933 and 1934 proved to be a profitable way to keep small boats and their crews active, and provided a living for fishermen who could not afford ring nets—in fact striker fishing furnished the wherewithal for the purchase of a number of ring nets, as will be seen below. Furthermore, live bait fishing provided a way for commercial fishermen to make use of the mackerel that frequent areas legally closed to net fishing, such as Santa Monica Bay and Catalina Island. These areas are set side as sanctuaries where the fish can not be harrassed by ring nets and purse seines, but there are no

restrictions on commercial hook and line fishing, so the striker boats do a great deal of fishing there, particularly in Santa Monica Bay.[10]

The Striker Boat During the Period 1935-1937

In 1935 a number of the larger striker boats blossomed out with new ring nets and left the ranks of the bait boats. Furthermore, many lampara boat fishermen obtained large boats in 1935, leaving their old boats to be taken over by erstwhile striker fishermen who in turn tied up their own boats. As a result there were less boats actively engaged in striker fishing. According to the fishermen, 1935 was a poor year for striker fishing in any event—the mackerel would not bite or even come up to the chum. Consequently many of the striker fishermen laid up their boats or went albacore fishing.

Although we have not computed detailed figures on the striker boat catch for 1935, our field observations lead us to believe that the landings of striker-caught mackerel were very much less than in 1934.

In 1936 and 1937 there was practically no mackerel striker fishing at San Pedro proper. Lampara boats and live bait boats alike had been crowded out of the fishery by purse seine boats. By that time, nearly all the small boat fishermen had done one of two things: they either disposed of their small boats entirely and fished on purse seiners, or they used their small boats for albacore and tuna live bait fishing during runs of those species and used purse seiners for all their mackerel and sardine fishing—in other words they had become two-boat fishermen.

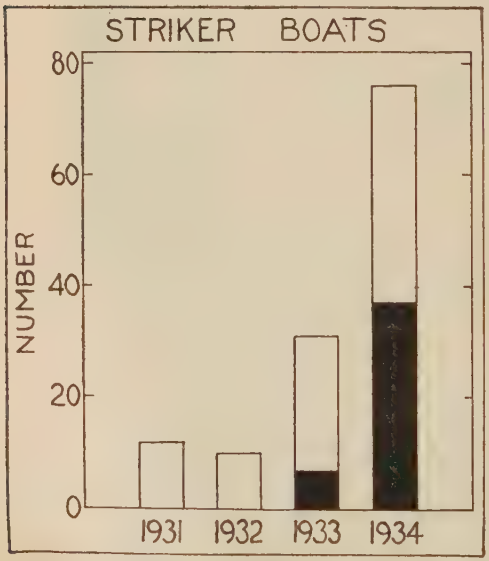

FIG. 33. Number of striker boats that fished each year for mackerel in the Los Angeles region. Solid squares indicate number of boats that fished regularly (*i.e.*, made more than 20 catches); white squares indicate boats that made occasional landings.

However, a great many small boats at Newport carried on striker fishing during those years. A number of factors favor the continuance of striker fishing at Newport; there are many small boats there that would otherwise lie idle, Newport fishermen are individualists and prefer line fishing to netting with large crews, the canneries are small and can not handle large loads so they prefer to buy fish from the small boats.

At present it appears as if the striker boat will not again become a factor of importance in the mackerel fishery unless mackerel become

[10] In 1935 a law was passed prohibiting chumming with live bait in the closed area at Catalina Island, but no restriction was placed on the use of ground chum.

so scarce as to make purse seiners with their large crews unprofitable to operate. Then the small boats can operate on a more nearly equal basis.

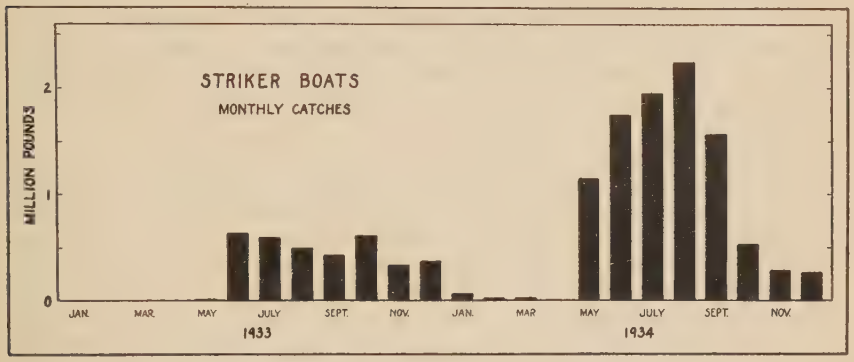

FIG. 34. Monthly mackerel catches made by striker boats in the Los Angeles region, 1933-1934. Note that the seasonal landings of striker boats parallel the catches of lampara and purse seine boats (see Figs. 11 and 16).

Seasonal Catches of Striker Boats

The striker boats make their heaviest landings during the summer months. (See Fig. 34.) That is the time of year when mackerel are most abundant. Like net boats, the live bait boats can operate successfully only when mackerel are available in good numbers. Hence there is usually no striker fishing from January to April, inclusive, which is the annual period of scarcity. However, when a good run occurs at this time (as in 1938), the striker boats do not hesitate to take advantage of it.

PLEASURE FISHING BOATS

In the Los Angeles region there are over 200 boats engaged in carrying passengers on fishing trips. There are three general classes of pleasure fishing boats: those that take out special parties on charter trips, known as charter boats; those that operate on daily schedule, known as party boats; and anchored fishing barges that have frequent shore boat service.

These boats, which operate the year around although they are most active in the summer, accommodate hundreds of thousands of anglers annually. These fishermen catch great quantities of many kinds of fish, including mackerel. Most of this fish never goes to market, so it does not enter into our commercial catch records. A rather considerable amount of sport-caught fish is sold, however. Sometimes boat crew members sell fish left behind or given to them by the anglers, some sport fishermen sell enough to defray the expenses of their outing and some commercial fishermen do their fishing on the party boats and barges. Some of the fish thus sold goes to the regular wholesale markets and appears in our commercial catch records, but most of it is peddled here and there or sold after the fishermen have smoked it in backyard smokehouses. The net result of all this is that very little of the pleasure boat catch gets into the records of commercial landings.

Mackerel is one of the leading sport fishes of southern California, but not many of the mackerel caught on the pleasure boats are sold. The relatively low price that mackerel bring does not make it worth while to carry them to the market. Those fishermen who sell their catches concentrate on higher priced fish and deliberately avoid the boats that catch lots of mackerel.

The recorded amounts of pleasure-boat mackerel that are sold do not bulk very large. In 1931 the total was 7,979 pounds. The figure was even less in the next three years, gradually dropping to 2,526 pounds in 1934. Thirty-five pleasure boats reported sales of mackerel in 1931. The next year 17 were represented. In 1933 there were 22 and in 1934 there were 21. (See Tables 1 to 4, inclusive.) Only two of these boats reported more than 20 sales of mackerel in a year—one made 55 sales in 1931 and 30 in 1932 and another made 28 in 1934. Individual sales were small, averaging about 35 pounds.

Many of the pleasure party boats go commercial fishing during the slack season. As it is all crew fishing, *i.e.*, no passengers, these boats have been placed in the various other categories for the purpose of this paper. Sometimes they use their bait nets to catch mackerel and a few even use ring nets. In both cases they have been classed as "lampara boats." Others use strikers, hand lines and set lines.

For the period 1931 to 1934 we have no accurate figures on the amounts of mackerel caught by sport fishermen. In 1936 a system for obtaining catch records from pleasure boat operators was instituted. During that year practically all of the boats reported their catches, but many neglected to record mackerel catches because on the sport fishing boats mackerel are despised as being too common and too small. So the recorded sport catch of 400,000 pounds in the Los Angeles region is undoubtedly far short of the actual catch of mackerel.

SUMMARY

In the foregoing discussion, the importance of each type of boat in the mackerel fishery has been recounted. Thus we saw that the lampara boat came into prominence in 1928 and for several years supported the cannery fishery almost alone. Competition of the more efficient purse seine boat, however, virtually drove the lampara boat out of the fishery in 1936. Purse seiners were not an outstanding factor in the mackerel industry until the boom that started in 1933, since which time they have steadily gained in relative importance. The gill net boat has never been prominent in the Los Angeles mackerel fishery, although it contributes small annual catches. Set line boats have always dominated the fresh fish mackerel trade and still do. Skiffs are of minor importance in the fishery but account for a fairly large proportion of the deliveries made at Newport. Striker boats were of considerable importance in 1928 and 1929 but did not figure in the fishery during the depressed period from 1930 to 1932. Since then they have accounted for a rather large proportion of the cannery catch, particularly at Newport. Pleasure fishermen catch considerable quantities of mackerel, but only an insignificant part of their catch is sold in the markets.

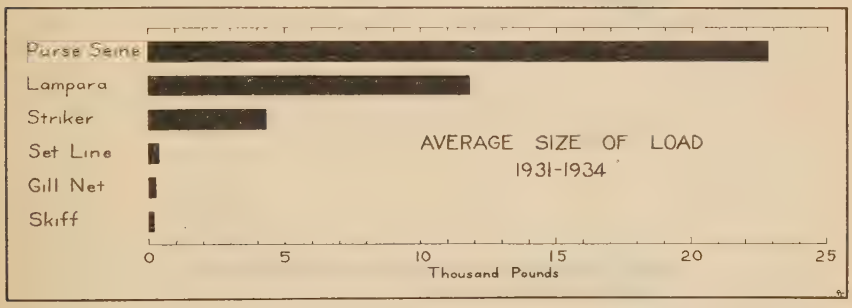

FIG. 35. The average sizes of individual landings of mackerel made by the various types of boats in the Los Angeles region during the period 1931-1934, inclusive.

As we have discussed the mackerel fishery bit by bit, taking up each type of boat separately, it may be that we have lost sight of the fishery as a whole. Consequently, in conclusion, we will present a brief survey of the fishery as it was each year in so far as the various types of boats are concerned.

Prior to 1928, the mackerel fishery was of minor importance. Set line boats accounted for most of the landings. Occasionally lampara boats, purse seiners and striker boats caught mackerel and brought them ashore, but their catches usually glutted the market which discouraged them from further fishing for mackerel. The canneries which packed mackerel from time to time were supplied by all kinds of boats, using all kinds of gear.

When the mackerel canning industry suddenly came to life in 1928 and 1929, every available boat turned to mackerel fishing and the total catch increased greatly. (See Fig. 4.) During these two years, however, the lampara boat as a class was the most important. Boats

of this type used both ring nets and lamparas in 1928 and ring nets only in 1929. They accounted for 74.4 per cent of the cannery catch during the summer of 1929, which is probably a typical period of the first two years of the industry. During the same time, purse seine boats (using both purse seines and ring nets) landed 19.4 per cent of the cannery mackerel, and hook and line boats of all kinds delivered but 6.2 per cent. Most of the hook and line catches were made by striker boats but some were made by set liners.

In 1930, mackerel canning was drastically curtailed. (See Fig. 4.) During the first half of the year, however, conditions were not much different than in 1929; prices were still high and all types of boats remained in the fishery. After midsummer the fishermen were offered just one-third the price they had been receiving and many boats quit fishing. Those deserting the fishery included all the striker boats. During the fall of 1930, cannery fishing was carried on by both purse seine and lampara boats. Purse seiners (using ring nets) delivered 56.1 per cent of the fish, and lampara boats (also using ring nets) accounted for 43.4 per cent. Set line boats supplied most of the mackerel delivered to the wholesale markets in 1930 and also made a few deliveries to canneries.

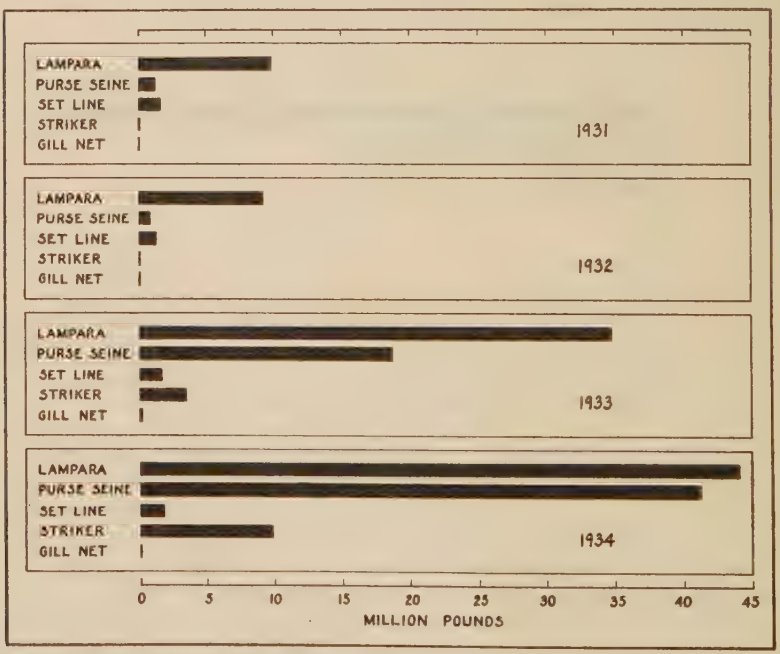

FIG. 36. Comparison of the annual mackerel catches of the various types of boats in the Los Angeles region, 1931-1934. For the purpose of this figure, set line and skiff landings have been combined. Among the points to be noted are: the large increase shown in the lampara boat deliveries is overshadowed by the tremendous gain in purse seine boat catches; the increase in striker boat catches due to the resumption of large scale canning in 1933; the uniformity in the annual catches of set line boats; the unimportance of the gill net in the mackerel fishery.

In 1931, another poor year, the lampara boat was again the most important type of boat in the mackerel fishery, catching 9,881,552 pounds, or 77.5 per cent of the total mackerel catch in the Los Angeles region. (See Fig. 36 and Table 1.) Most of this amount was delivered to canneries. Set line boats, fishing entirely for the markets, caught 1,514,409 pounds, or 11.9 per cent of the total. Purse seine boats were of little importance, accounting for no more than 9.5 per cent of the mackerel landings. A total of 289 boats caught mackerel commercially in 1931. Of this number, only 66 fished regularly.

Conditions were essentially the same in 1932. The total catch was approximately the same and the various kinds of boats contributed similar shares to the total. Lampara boats accounted for 79.8 per cent, set liners for 10.8 per cent, and purse seiners for 8.4 per cent. (See Table 2.) The number of boats catching mackerel dropped to 251 in 1932. However, more boats fished consistently, as 77 made more than 20 deliveries.

Because the domestic market for inexpensive canned fish had improved greatly, there was a rebirth of the mackerel canning industry in 1933. Canneries sent out all the boats they had and removed the low boat limits that had curtailed catches during the previous three years. As a consequence of this impetus, the catches of lampara and purse seine boats increased enormously and striker boats again became a factor in the fishery. Lampara boats (using ring nets) still dominated the fishery, with a catch of 34,870,811 pounds, which was 59.2 per cent of the total. Purse seiners (using ring nets and purse seines) caught 18,659,866 pounds of mackerel, or 31.7 per cent of the total catch. Striker boats, with 3,517,934 pounds (6 per cent) were third in order of importance. Although set line catches were a little larger than the previous year, amounting to 1,388,874 pounds, the great increase in the catches of other types of boats caused them to be relatively less important (2.4 per cent). The fresh fish markets did not share in the mackerel boom, so it was only the boats that fished for the canneries, principally lampara, purse seine and striker boats, that benefited to any marked degree. The increase in catch is reflected in the number of boats landing mackerel. A total of 314 boats caught mackerel in 1933. Of these 129 fished regularly.

Marketing conditions for canned mackerel were even better in 1934. More boats entered the fishery and the catch rose to record heights. As far as the boats are concerned, the most interesting feature of 1934 is the rise in importance of the purse seine boat. Although the lampara boats still led with a catch of 44,153,724 pounds, their share of the total was cut to 45.5 per cent, as purse seiners increased their catches greatly. The purse seine fleet accounted for 42.5 per cent of the total, with a catch of 41,277,908 pounds. Striker boats also increased their share, catching 9,865,430 pounds, or 10.2 per cent. Set line catches again showed a slight improvement, increasing to 1,559,334 pounds, which however was but 1.6 per cent of the total. The number of boats in the mackerel fleet increased to 359 in 1934. Nearly half of these (154) fished regularly.

The fishery continued to expand in 1935 as many new boats were commissioned. (See Fig. 4.) Since 1934 we have segregated the catches of the various types of boats only in a general way so no per-

centages can be given. However, the dominance of the purse seine boat in 1935 was so overwhelming as to be manifest to even a casual observer. Not only did lampara boat catches drop, but even the striker boats did little fishing. In 1935, a total of 331 boats caught mackerel. In 1936, the total catch dropped considerably, due to a scarcity of fish. Purse seiners continued to dominate the fishery as more and more lampara boat fishermen took over the larger boats to operate. Striker fishing continued at low ebb, centering principally at Newport. A total of 414 boats caught mackerel commercially in 1936. In spite of intensive fishing effort, the catch dropped still further in 1937 as the scarcity of fish became even more pronounced. The cannery fishery was carried on almost entirely by purse seiners. Striker fishing was somewhat improved and a large number of striker boats engaged in mackerel fishing, but there were practically no lampara boats left in the fleet. As a proof of the intensity of fishing in 1937 is the fact that 477 boats made landings of mackerel in the Los Angeles region.

The preceding pages have given an idea of the marked changes taking place in the mackerel fishery during the ten years of its history. During that time canning and marketing methods, although steadily improving, have shown no significant changes. It is the fishing fleet and fishing methods that have changed. A whole new fleet has been built up to exploit both mackerel and sardines during the last several years and many old boats have dropped out of the fishery or have been compelled to improve their fishing gear. No doubt the next ten years will see just as many changes.

To bring this discussion to a close, we present a graph showing the monthly catches of mackerel in the Los Angeles region for the ten-year period, 1928-1937. (See Fig. 37.) Scrutiny of this figure reveals the ups and downs of the mackerel industry from year to year, it shows the highly seasonal nature of the fishery and it demonstrates the violent fluctuations that occur from one month to the next. The variations—annual, seasonal and monthly (daily for that matter)—are due to a number of reasons. Availability of the fish is of prime importance—if fish are scarce there can be no large catches. Weather conditions play a large part in this fishery as in any other. Various economic factors must be taken into account: the condition of the market dictates whether or not the canners send their boats fishing; the capacity of the plants determines how much fish they can handle; fishermen's or cannery workers' strikes may curtail catches; the competition of other fisheries affects the mackerel catches—during the sardine season or when tuna are running some of the boats are diverted to those fisheries.

It will be noticed that throughout the ten-year period, catches are generally light in the late winter and spring, January through April. These light catches are due to the annual scarcity of mackerel at that season. November and December catches are generally less than those of the early fall months. The reason for this is that the sardine season opens in November and the canneries usually prefer to handle sardines then. The low catches throughout 1930, 1931 and 1932 were due to the temporary collapse of the market for canned mackerel which was in turn due to the general depression. The enormous catches of 1934 and 1935 were due to expanded markets which resulted in additional can-

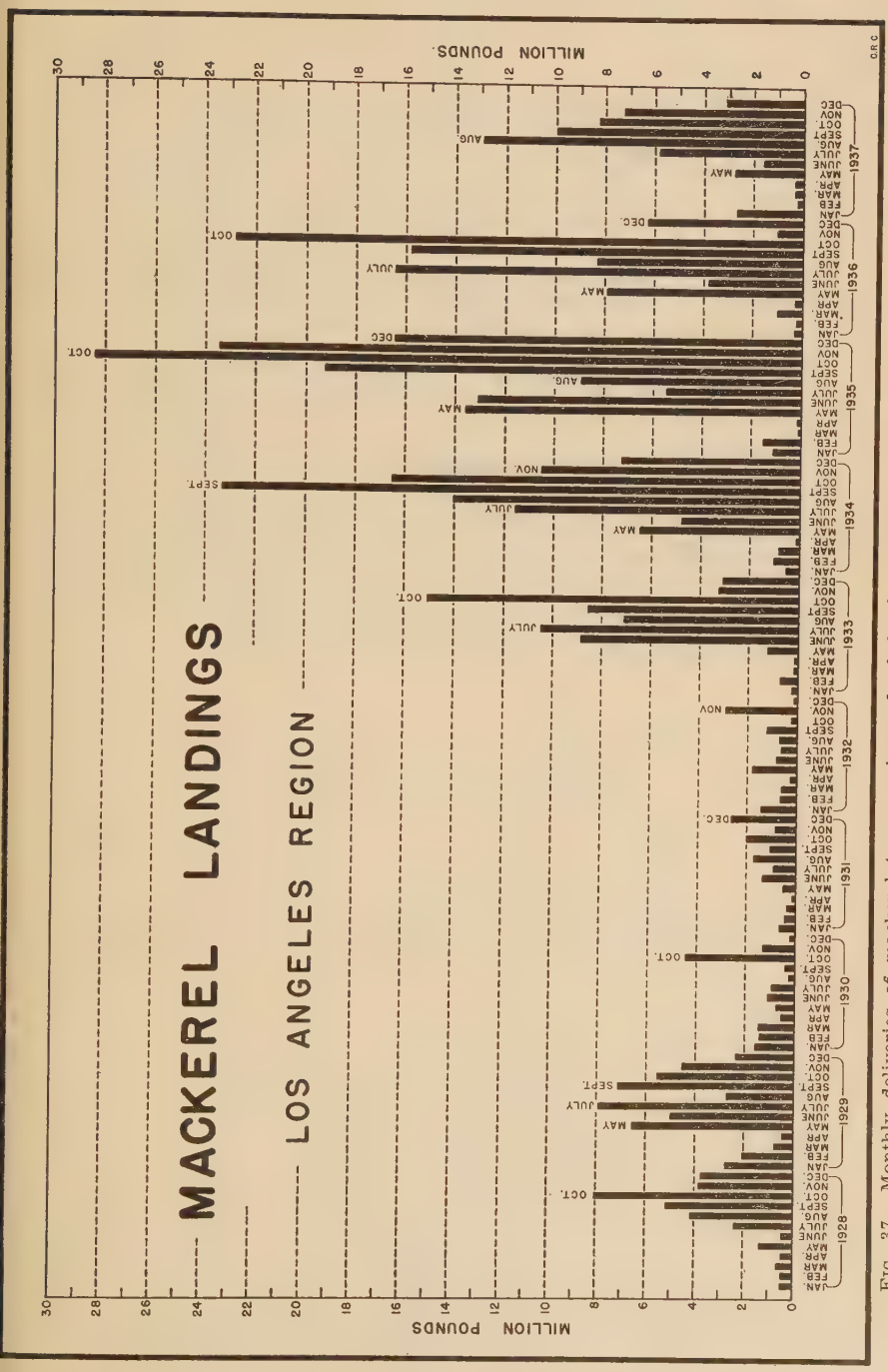

FIG. 37. Monthly deliveries of mackerel to canneries and wholesale markets in the Los Angeles region, 1928-1937.

nery capacity and in many new boats. The lighter catches of 1936 and 1937 were caused by the scarcity of mackerel which was a direct result of overfishing.

As a matter of interest some of the minor features of the monthly catch graph can be pointed out. The light catch of August, 1929, was due to the fishermen's inability to locate mackerel during a period of about two weeks. The relatively large catch of October, 1930, was made because two canners decided to concentrate their packs for that year in one month. Consequently they held their boats in at other times. The 1933 boom really started in November, 1932, when the market opened up, but the annual period of mackerel scarcity commenced early (in December, which was one of the poorest months on record) and lasted until mid-May, so although the canneries were anxious to get under way they had to wait nearly six months. Beginning with 1933, any fluctuations occurring during the summer and early fall months (June to October, inclusive) have been due to relative availability of fish—the boats have fished steadily during this whole period. A fishermen's strike was responsible for the small catch of November, 1936—no net boats fished for mackerel (or sardines) during that month. As an indication that fluctuations within a month also occur, we can mention two examples. The greater part of the catch of November, 1934, was made on one day, when the entire mackerel and sardine fleets came in with mackerel. Nearly all of the September, 1937, catch was made on the first two days and the last three days of the month.

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TABLE 1

MACKEREL LANDINGS IN LOS ANGELES REGION—1931

Type of boat	Total landings, pounds	Percentage of catch	Number of boats	Number of trips	Average number trips per boat	Average pounds per trip
Lampara	9,881,552	77.53	39	1,042	26.7	9,483
Purse seine	1,206,375	9.47	14	54	3.8	22,340
Gill net	29,921	0.23	35	218	6.2	137
Set line	1,514,409	11.88	112	4,145	37.0	365
Striker	9,135	0.07	12	28	2.3	326
Skiff	95,393	0.75	57	585	10.2	163
Pleasure	7,979	0.06	35	221	6.3	36
All boats	12,744,764		*289	6,293	21.8	

* Of the 289 boats landing mackerel, 15 used 2 types of gear.

TABLE 2
MACKEREL LANDINGS IN LOS ANGELES REGION—1932

Type of boat	Total landings, pounds	Percentage of catch	Number of boats	Number of trips	Average number trips per boat	Average pounds per trip
Lampara	9,269,197	79.76	33	1,271	38.5	7,293
Purse seine	969,156	8.34	21	103	4.9	9,409
Gill net	37,344	0.32	38	236	6.2	158
Set line	1,250,081	10.76	94	3,661	38.9	341
Striker	11,737	0.10	10	24	2.4	489
Skiff	80,491	0.69	42	622	14.8	129
Pleasure	3,874	0.03	17	110	6.5	35
All boats	11,621,880		*251	6,027	24.0	

* Of the 251 boats landing mackerel, 4 used 2 types of gear.

TABLE 3
MACKEREL LANDINGS IN LOS ANGELES REGION—1933

Type of boat	Total landings, pounds	Percentage of catch	Number of boats	Number of trips	Average number trips per boat	Average pounds per trip
Lampara	34,870,811	59.21	45	2,979	66.2	11,706
Purse seine	18,659,866	31.68	33	1,155	35.0	16,156
Gill net	171,787	0.29	32	513	16.0	335
Set line	1,388,874	2.36	115	3,870	33.7	359
Striker	3,517,934	5.97	31	728	23.5	4,832
Skiff	283,532	0.48	52	1,346	25.9	211
Pleasure	3,113	0.01	22	71	3.2	44
All boats	58,895,917		*314	10,662	34.0	

* Of the 314 boats that landed mackerel, 14 used 2 types of gear and 1 used 3 types.

TABLE 4
MACKEREL LANDINGS IN LOS ANGELES REGION—1934

Type of boat	Total landings, pounds	Percentage of catch	Number of boats	Number of trips	Average number trips per boat	Average pounds per trip
Lampara	44,153,724	45.46	48	3,030	63.1	14,572
Purse seine	41,277,908	42.50	69	1,413	20.5	29,213
Gill net	22,023	0.02	15	94	6.3	234
Set line	1,559,334	1.61	101	3,611	35.8	432
Striker	9,865,430	10.16	76	2,341	30.8	4,214
Skiff	246,949	0.25	54	1,075	19.9	230
Pleasure	2,526	0.00	21	90	4.3	28
All boats	97,127,894		*359	11,654	32.5	

* Of the 359 boats landing mackerel, 25 used 2 types of gear.

TABLE 5
MACKEREL LANDINGS IN LOS ANGELES REGION—1931-1934, INCLUSIVE

Type of boat	Total landings, pounds	Percentage of catch	Number of trips	Average pounds per trip
Lampara	98,175,284	54.42	8,322	11,797
Purse seine	62,113,305	34.43	2,725	22,794
Gill net	261,075	0.14	1,061	246
Set line	5,712,698	3.17	15,287	374
Striker	13,404,236	7.43	3,121	4,295
Skiff	706,365	0.39	3,628	195
Pleasure	17,492	0.01	492	36
All boats	180,390,455		34,636	

TABLE 6

MONTHLY MACKEREL LANDINGS IN THE LOS ANGELES REGION—1931

Type of boat	JANUARY			FEBRUARY			MARCH			APRIL		
	Total landings, pounds	Number of boats	Number of trips	Total landings, pounds	Number of boats	Number of trips	Total landings, pounds	Number of boats	Number of trips	Total landings, pounds	Number of boats	Number of trips
Lampara	407,592	12	53	235,512	5	24	106,792	5	15	2,120	2	2
Purse seine				412	2	2	64,565	1	1	195	2	2
Gill net	83	1	1	389	5	7	241	3	5	2,590	12	29
Set line	225,698	60	494	210,289	48	477	186,871	43	480	147,703	46	431
Striker												
Skiff	8,897	18	51	10,944	17	50	7,381	16	45	4,229	18	40
Pleasure	1,731	6	38	862	7	21	1,225	14	34	932	12	26
All boats	644,001	97	637	458,408	84	581	367,075	82	580	157,769	92	530

Type of boat	MAY			JUNE			JULY			AUGUST		
	Total landings, pounds	Number of boats	Number of trips	Total landings, pounds	Number of boats	Number of trips	Total landings, pounds	Number of boats	Number of trips	Total landings, pounds	Number of boats	Number of trips
Lampara	314,787	10	51	1,179,043	24	156	849,002	14	108	1,343,368	10	109
Purse seine	59,487	2	10	124,438	2	10				299,603	3	6
Gill net	19,177	27	134	5,435	13	22	1,177	4	6	300	1	1
Set line	109,524	42	398	56,009	33	251	54,124	26	215	79,668	33	278
Striker	752	3	7	2,777	5	7	125	1	1	2,137	3	5
Skiff	3,789	17	34	1,496	10	31	797	8	13	3,964	13	43
Pleasure	391	9	11	276	8	14	386	8	11	76	4	4
All boats	507,907	110	645	1,369,474	95	491	905,611	61	354	1,729,116	67	446

TABLE 6– Continued

MONTHLY MACKEREL LANDINGS IN THE LOS ANGELES REGION· 1931

Type of boat	SEPTEMBER			OCTOBER			NOVEMBER			DECEMBER		
	Total landings, pounds	Number of boats	Number of trips	Total landings, pounds	Number of boats	Number of trips	Total landings, pounds	Number of boats	Number of trips	Total landings, pounds	Number of boats	Number of trips
Lampara	974,397	12	88	1,641,130	16	169	628,561	16	72	2,199,248	18	195
Purse seine	12,565	1	1	249,930	2	4	122,540	2	3	272,640	4	15
Gill net	20	1	1	209	2	3	228	2	6	72	3	3
Set line	83,834	26	242	85,732	34	254	106,009	41	276	168,948	43	349
Striker	260	1	1	50	1	1	2,934	1	5	100	1	1
Skiff	13,526	18	71	15,573	21	92	16,961	20	75	7,836	16	40
Pleasure	191	4	5	220	4	12	807	7	24	882	5	21
All boats	1,084,793	63	409	1,992,844	80	535	878,040	89	461	2,649,726	90	624

TABLE 7

MONTHLY MACKEREL LANDINGS IN THE LOS ANGELES REGION—1932

Type of boat	JANUARY			FEBRUARY			MARCH			APRIL		
	Total landings, pounds	Number of boats	Number of trips	Total landings, pounds	Number of boats	Number of trips	Total landings, pounds	Number of boats	Number of trips	Total landings, pounds	Number of boats	Number of trips
Lampara	1,231,798	13	107	393,940	16	87	421,820	16	79	166,805	16	47
Purse seine	75	1	1	94,233	7	16	21,467	6	6	285	1	1
Gill net	38	1	4	855	3	5	602	3	8	1,213	8	17
Set line	202,700	48	460	185,080	42	485	168,751	44	467	102,306	38	341
Striker										208	1	2
Skiff	13,072	15	66	10,411	15	69	6,685	17	53	6,160	16	57
Pleasure	572	3	22	326	3	9	182	1	6	359	3	6
All boats	1,448,255	81	660	684,845	86	671	619,507	87	619	277,336	83	471

Type of boat	MAY			JUNE			JULY			AUGUST		
	Total landings, pounds	Number of boats	Number of trips	Total landings, pounds	Number of boats	Number of trips	Total landings, pounds	Number of boats	Number of trips	Total landings, pounds	Number of boats	Number of trips
Lampara	1,608,666	24	224	760,258	18	125	269,823	16	69	542,673	20	126
Purse seine	85,044	1	9	46,785	2	5	315,467	5	34	122,385	5	17
Gill net	23,908	33	140	7,988	14	37	1,550	6	13	190	2	2
Set line	98,073	39	295	32,191	27	160	46,697	22	151	46,015	30	198
Striker	321	2	4	1,729	4	8	918	2	3	8,190	3	6
Skiff	8,428	24	82	4,788	16	59	2,697	6	27	2,192	8	32
Pleasure	555	8	19	449	7	14	180	2	2	250	6	6
All boats	1,824,995	131	773	854,188	88	408	637,332	59	299	721,895	74	387

TABLE 7—Continued

MONTHLY MACKEREL LANDINGS IN THE LOS ANGELES REGION—1932

Type of boat	SEPTEMBER			OCTOBER			NOVEMBER			DECEMBER		
	Total landings, pounds	Number of boats	Number of trips	Total landings, pounds	Number of boats	Number of trips	Total landings, pounds	Number of boats	Number of trips	Total landings, pounds	Number of boats	Number of trips
Lampara	1,010,565	15	109	178,725	15	84	2,677,644	26	205	6,480	4	9
Purse seine	151,365	4	9				131,950	3	4	100	1	1
Gill net				223	3	4				777	2	6
Set line	60,287	33	215	63,955	36	216	98,018	37	289	146,008	41	384
Striker										371	1	1
Skiff	3,785	10	42	3,223	14	33	6,539	10	40	12,511	17	62
Pleasure	370	2	4	162	2	6	315	4	10	154	3	6
All boats	1,226,372	64	379	246,288	70	343	2,914,466	80	548	166,401	69	469

TABLE 8

MONTHLY MACKEREL LANDINGS IN THE LOS ANGELES REGION—1933

Type of boat	JANUARY			FEBRUARY			MARCH			APRIL		
	Total landings, pounds	Number of boats	Number of trips	Total landings, pounds	Number of boats	Number of trips	Total landings, pounds	Number of boats	Number of trips	Total landings, pounds	Number of boats	Number of trips
Lampara	128,894	12	36	525,811	17	77	67,259	12	29	9,422	3	3
Purse seine	720	1	1	23,695	3	4				900	1	1
Gill net	1,051	3	14	50	1	1	189	4	4	658	4	11
Set line	128,392	43	391	142,866	49	447	120,394	46	404	145,274	43	472
Striker												
Skiff	15,278	21	86	16,321	21	92	3,470	11	38	8,536	20	67
Pleasure	155	3	4	10	1	1	70	2	3			
All boats	274,490	83	532	708,753	92	622	191,382	75	478	164,790	71	554

Type of boat	MAY			JUNE			JULY			AUGUST		
	Total landings, pounds	Number of boats	Number of trips	Total landings, pounds	Number of boats	Number of trips	Total landings, pounds	Number of boats	Number of trips	Total landings, pounds	Number of boats	Number of trips
Lampara	920,855	24	120	5,588,675	31	565	6,436,490	33	575	3,886,993	34	297
Purse seine	219,748	12	31	2,436,465	15	254	3,271,860	17	260	2,617,594	16	147
Gill net	22,282	22	129	69,735	26	179	68,389	22	144	7,538	9	20
Set line	50,361	45	208	72,879	35	208	73,810	32	191	70,198	34	244
Striker	8,380	3	6	641,895	16	135	593,490	13	109	498,465	9	94
Skiff	6,357	19	43	6,716	23	85	13,292	20	105	18,998	21	143
Pleasure	45	1	2	205	5	7	91	1	3	523	2	5
All boats	1,228,028	126	539	8,816,570	151	1,433	10,457,422	138	1,387	7,100,309	125	950

TABLE 8—Continued

MONTHLY MACKEREL LANDINGS IN THE LOS ANGELES REGION—1933

Type of boat	SEPTEMBER			OCTOBER			NOVEMBER			DECEMBER		
	Total landings, pounds	Number of boats	Number of trips	Total landings, pounds	Number of boats	Number of trips	Total landings, pounds	Number of boats	Number of trips	Total landings, pounds	Number of boats	Number of trips
Lampara	5,055,438	36	421	7,895,518	37	496	2,108,022	29	158	2,247,434	20	202
Purse seine	2,927,325	17	195	6,357,427	16	235	554,602	10	21	249,530	6	6
Gill net	396	2	3	105	1	1	1,150	2	5	244	2	2
Set line	99,115	46	297	150,876	47	346	165,261	46	316	169,448	47	346
Striker	433,520	7	78	617,537	9	90	343,279	14	82	381,368	17	134
Skiff	29,495	24	171	42,253	17	179	75,307	23	176	47,509	25	161
Pleasure	855	12	21	731	7	16	308	4	6	120	2	3
All boats	8,546,144	144	1,186	15,064,447	134	1,363	3,247,929	128	764	3,095,653	119	854

TABLE 9

MONTHLY MACKEREL LANDINGS IN THE LOS ANGELES REGION—1934

Type of boat	JANUARY			FEBRUARY			MARCH			APRIL		
	Total landings, pounds	Number of boats	Number of trips	Total landings, pounds	Number of boats	Number of trips	Total landings, pounds	Number of boats	Number of trips	Total landings, pounds	Number of boats	Number of trips
Lampara	267,181	17	52	367,967	21	46	480,463	17	74	246	2	4
Purse seine	61,670	6	6	426,115	9	10	84,220	3	5	866	3	3
Gill net	25	1	1	194	2	3	100	1	1			
Set line	149,978	44	359	168,977	51	360	215,214	46	444	141,008	44	359
Striker	64,212	8	27	19,436	5	15	19,829	7	9			
Skiff	29,667	23	111	44,012	26	150	31,689	23	126	14,949	25	74
Pleasure	102	1	4	162	3	4	137	3	5	69	3	4
All boats	572,835	100	560	1,026,863	117	588	831,652	100	664	157,138	77	444

Type of boat	MAY			JUNE			JULY			AUGUST		
	Total landings, pounds	Number of boats	Number of trips	Total landings, pounds	Number of boats	Number of trips	Total landings, pounds	Number of boats	Number of trips	Total landings, pounds	Number of boats	Number of trips
Lampara	3,138,197	35	425	2,048,299	31	358	4,421,160	33	453	7,190,625	33	475
Purse seine	1,981,430	31	231	866,250	14	89	5,054,674	30	214	4,513,543	15	133
Gill net				312	2	3	13,648	8	46	4,234	5	22
Set line	206,558	43	422	127,877	33	313	103,173	33	265	79,755	32	203
Striker	1,147,069	24	251	1,754,774	35	456	1,944,537	44	587	2,243,982	43	453
Skiff	23,134	22	115	16,883	21	106	9,916	16	56	14,630	20	71
Pleasure	470	7	20	281	3	14	371	4	10	373	8	11
All boats	6,496,858	162	1,464	4,814,676	139	1,339	11,547,479	168	1,631	14,047,142	156	1,368

TABLE 9—Continued

MONTHLY MACKEREL LANDINGS IN THE LOS ANGELES REGION—1934

Type of boat	SEPTEMBER			OCTOBER			NOVEMBER			DECEMBER		
	Total landings, pounds	Number of boats	Number of trips	Total landings, pounds	Number of boats	Number of trips	Total landings, pounds	Number of boats	Number of trips	Total landings, pounds	Number of boats	Number of trips
Lampara	12,178,059	33	510	7,586,095	36	370	4,282,053	26	167	2,193,379	26	96
Purse seine	9,546,073	23	269	8,295,490	26	244	5,790,697	40	107	4,656,880	46	102
Gill net	2,255	2	13	790	2	3				465	1	2
Set line	65,275	30	176	71,108	33	226	113,505	40	231	116,906	31	253
Striker	1,570,901	37	252	531,584	27	101	292,818	14	102	276,288	17	88
Skiff	12,010	20	66	14,936	19	57	21,851	17	69	13,272	25	74
Pleasure	127	3	4	144	4	5	159	2	3	131	3	6
All boats	23,374,700	148	1,290	16,500,147	147	1,006	10,501,083	139	679	7,257,321	149	621

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